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THE ANGLE SYSTEM

OF

REGULATION AND RETENTION OF THE TEETH,

AND

TREATMENT OF FRACTURES OF THE MAXILLÆ.

FIFTH EDITION REVISED.

WITH ONE HUNDRED AND FIFTEEN ILLUSTRATIONS.

BY

EDWARD H. ANGLE, D.D.S.,

MEMBER OF THE AMERICAN DENTAL ASSOCIATION, AND HONORARY MEMBER OF THE AMERICAN DENTAL SOCIETY OF EUROPE; FORMER PROFESSOR OF HISTOLOGY, ORTHODONTIA, AND COMPARATIVE ANATOMY OF THE TEETH, IN THE DENTAL DEPARTMENT OF THE UNIVERSITY OF MINNESOTA; PROFESSOR OF ORTHODONTIA AND LECTURER ON FRACTURES OF THE MAXILLÆ IN THE NORTHWESTERN UNIVERSITY DENTAL SCHOOL, CHICAGO, ILL.; PROFESSOR OF ORTHODONTIA IN THE DENTAL DEPARTMENT OF THE MARION-SIMS COLLEGE OF MEDICINE, ST. LOUIS, MO.; SURGEON TO THE ASBURY HOSPITAL IN MINNEAPOLIS, MINN., AND SURGEON FOR THE TREATMENT OF FRACTURES OF THE MAXILLÆ TO THE GREAT NORTHERN RAILWAY.

PHILADELPHIA:
THE S. S. WHITE DENTAL MFG. CO.
1899.

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PREFACE TO THE FIFTH EDITION.

At the earnest solicitation of numerous students and teachers it had been the author's intention in preparing the fifth edition to rewrite and rearrange the subject-matter more in keeping with the exacting requirements of a complete, modern text-book on Orthodontia. But, owing to the fact that the fourth edition has had such a wide circulation, having been published in part in periodicals, compendiums, and text-books both dental and surgical, and complete translations in the French, German, Dutch, Scandinavian, and Spanish languages, it has been thought advisable, in order to prevent the confusion which would result from the rearranging of pages and numbering of cuts, to incorporate the new subject-matter in the form of a Supplement* into the corrected and but slightly modified fifth edition.

As the fruits of a busy practice,—the author has devoted his time exclusively to the practice and teaching of Orthodontia,—the Supplement will be found to contain numerous additions and modifications of combinations, also new combinations, together with suggestions and comparisons, and a more comprehensive plan of nomenclature and classification of irregularities from the basis of occlusion; all of which the author believes will still further simplify, for both student and teacher, the study and practice of this most useful branch of dental science.

Edward H. Angle.

St. Louis, Mo., August, 1897.

*This Supplement is now in course of preparation, but is delayed because of the necessity of making a large number of illustrations. When published it will be available to those who have the fourth edition, equally with the purchasers of this volume.—Publisher.

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PART I.

ORTHODONTIA.

CHAPTER I.

THE ANGLE SYSTEM OF TEETH-REGULATION AND RETENTION.

It is often asserted, even by some authoritative writers upon the treatment of dental irregularities (Orthodontia), that no *fixed system* of appliances should or can be depended upon; that each case so differs from all others as to require some new appliance peculiarly suited to that case, and that only.

Upon this theory, success would demand not only skill in operation, but the constant exercise of inventive genius. The inventive faculty is rather a natural gift than an acquirement, and can be exercised successfully only by the favored few, while even the greatest inventor must be an experimenter. Hence all treatment upon such theory must be, and in fact has ever been, tedious, costly, and of doubtful result.

It is probable that, for the foregoing reasons, Orthodontia has never received that attention, even in the schools of dentistry, that its importance demands.

The author believes, and has proven, that it is not only possible, but practicable, to systematize, classify, and provide ready-made regulating appliances, reducing them to a few simple forms, to meet by their combinations the requirements in all varieties of cases susceptible of treatment.

The present purpose is to submit such a system, explain the character and use of the appliances, and show by cuts of models of actual cases the methods of treatment. The appliances shown in Sets No. 1 and No. 2, and the few extra pieces following them, have, in fact, fully and readily met the requirements of every case, while combinations of them, other than those hereinafter shown, have rarely been necessary.

The author will always be glad to afford the profession ample opportunity to inspect his collection of models of actual cases treated, which correctly show each stage of the operation from beginning to completion; and he feels sure that, for variety of difficulties to be overcome, facility and certainty of operation, and success in results, all clearly shown by the models, this collection will compare favorably with any other in the world.

The claim made by many authors, teachers, and practitioners, that each dentist should from raw materials make his own appliances for use in Orthodontia, is quite as unreasonable and impractical as to require him to make all his own instruments for use in other branches of dentistry; and the time spent by the student in the dental schools to acquire constructive knowledge and skill for either purpose could and should be more profitably spent in the study of actual cases, and of the application of established forms of appliances and instruments made by skilled experts, who have become so not only from natural ability, but by intense study and long practice.

The author claims that his system can be easily taught and learned in the dental schools; that the dentist may quickly acquire a complete knowledge of it; and that the practice of Orthodontia, instead of being regarded, as heretofore, as tedious and unsatisfactory, something to be avoided rather than sought for, may be made one of the most useful, satisfactory, and lucrative branches of dentistry.

Dr. Farrar seems also to have become convinced of the practicability of what has been heretofore stated, for he says in vol. xx, page 20, of the *Dental Cosmos*,—

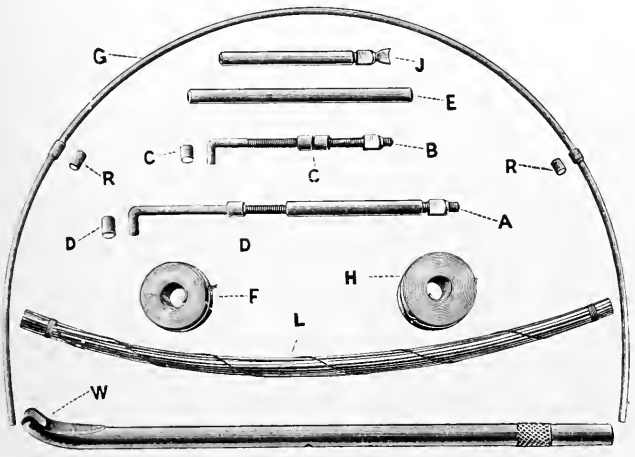
"It has for some time been evident to me (though by most people thought to be impracticable) that the time will come when the regulating process and the necessary apparatus will be so systematized and simplified that the latter will actually be kept in stock, in parts and wholes, at dental depots, in readiness for the profession at large, so that it may be ordered by catalogued numbers to suit the needs of any case; so that by a few moments' work at the blowpipe in the laboratory the dentist may be able, by uniting the parts, to produce any apparatus, of any size desired, at minimum cost of time and money."

Section I. The limits of this book will not permit of an exhaustive treatise on the subject of Orthodontia generally, and the author will therefore confine himself to the description and use of the appliances and methods of treatment which he has found so

satisfactory in an extensive practice, believing that most practitioners will succeed best by adopting one complete system and thoroughly familiarizing themselves with the same.

To those who may desire to study the subject in all its relations, together with the history of methods and appliances in general, he would recommend the excellent treatises of Drs. Guilford and Kingsley.

FIG. 1.



SET NO. 1. ANGLE'S APPLIANCES.

It is essential to a clear comprehension of the manifold uses of the several appliances to which frequent references will subsequently be made that their names, shapes, sizes, and indicating numbers or letters should be carefully noted and kept in mind. Every part is important; none can well be omitted.

For convenience of description and designation, they are divided into Sets No. 1 and No. 2, together with a few extra parts. Any piece, however, may be ordered separately, as all of a kind are interchangeable, and each accurately fits the part to which it belongs.

The Set No. 1, Fig. 1, consists of the retaining-wire G, and ten sections of retaining and anchor pipes R, R, which will closely slide on wire G. The traction-screw A has its smooth end bent for insertion in the short tube D. When the nut is against the A end of the long tube, and that tube soldered to a tooth-band, turning forward the nut will *pull* the hook in the tube D when that has been soldered to a tooth-band; if the nut is against the other end

of the long tube, it will *push* D and its tooth-band. B, C, is a like, but smaller combination, of the same diametric size as the jack-screw J. When the tube of J is soldered to a tooth-band on one tooth, it will *push* directly against a notched tooth-band or a tooth. E is a longer piece of the tube than is shown on J, with which a longer jack-screw may be made when required. The thinner coil of band-material is seen at F, the thicker at H, either of which is sufficient to make about twenty-five tooth-bands. The rotating levers L, three sizes of two each, and wrench W, complete the set, which will suffice for several regulating cases.

It will thus be seen that the appliances of this set are very simple and few in number, being limited practically to three,—viz, the lever for rotating, the screw for pushing, and the traction-screw for pulling; and the other pieces for the purpose of securing attachments. Aside from their advantages of simplicity, efficiency, and cleanliness, their intelligent application will effect a stationary anchorage upon, a positive movement of, and afterward a firm retention of, the teeth.

Section II. Set No. 2 is designed for the treatment of a special class of irregularities, or that prognathic type known as excessive protrusion of the upper incisors. The plan of this set (No. 2) differs principally from that of Set No. 1 in that the anchorage is occipital, or by means of a cap covering the back of the head (as seen in Fig. 3), to which heavy elastic bands are attached and received by the hooks upon the ends of traction-bar A.

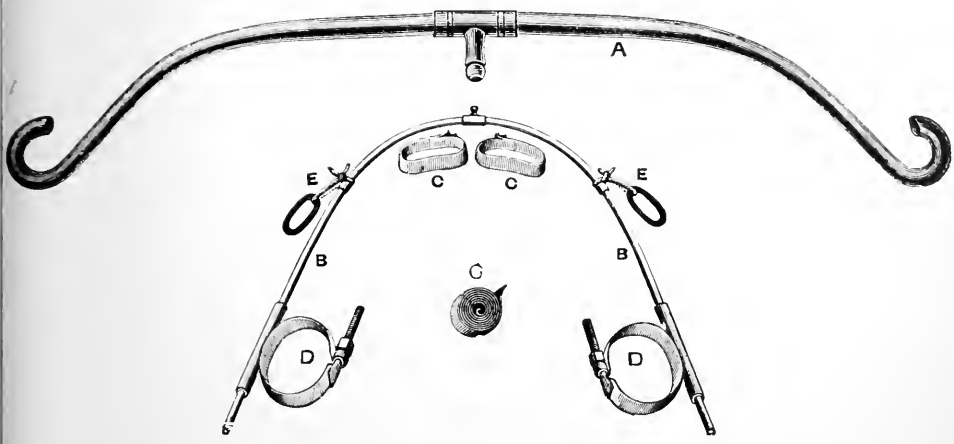
The wire arch B encircles the dental arch and bears against the protruding teeth, receiving the necessary pressure from the standard in the center of the traction-bar. D, D represent adjustable anchor clamp-bands and pipes for securing the ends of the arch B upon the molar teeth, while C, C represent plain bands for holding in position upon the teeth the anterior part of the arch, as shown in Fig. 84. C is a coil of band-material, from which the bands C, C are to be made for each case. This coil is the same as F, Fig. 1, Set No. 1.

E, E represent small rubber rings to retain the teeth during intervals of rest, when not wearing the head-cap and traction-bar, also shown in Fig. 84.

Extra Parts.

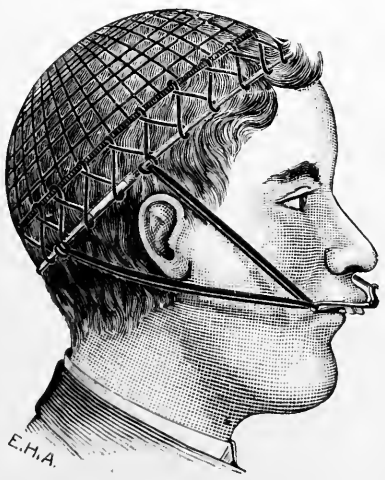
Section III. Fig. 4 shows an extra wire expansion-arch. Its use is directly the opposite of that of wire arch B, in that it is used for expanding the arch, and is to be known as the expansion-arch

FIG. 2.



SET NO. 2. ANGLE'S APPLIANCES.

FIG. 3.



E. The ends of this arch are threaded and provided with nuts. By putting the threaded ends into the anchor-tubes upon the clamp-bands D, Set No. 2, secured to anchor-teeth, the arch may be pushed forward by tightening the nuts, thus exerting force against other teeth which may have been secured to the arch by means of ligatures or bands.

[This arch is not included in Set No. 2, but must be ordered separately, as also the extra bands and tubes D, Fig. 2, with which it is always used.]

In Fig. 5 is shown a metal cap covering the chin, and in connection with the head-gear and heavy elastic bands it is used in the retraction of the inferior maxilla, as shown in the figure. This cap is light, nicely made, highly polished, and will fit all cases, as it is necessary for fit to be only approximately accurate. A layer of

Fig. 4.

absorbent cotton should always be placed between the metal and the chin while it is being worn.

Fig. 6 represents adjustable clamp-bands for encircling the

Fig. 5.

molars and bicuspids, to which are attached the various appliances. Nos. 3 and 4 have pins soldered to their sides, to which ligatures may be attached. This style of band is especially designed for the treatment of fractures of the maxillæ, and its use, therefore, is fully

shown in that portion of this work devoted to such treatment, but it is also useful in the regulation of teeth, as described later.

The head-cap represented as covering the back of the head (Fig. 5) is also an extra. It is beautifully made and presents a very neat

FIG. 6.

No. 1—BICUSPID. No. 2—MOLAR. No. 3—BICUSPID. No. 4—MOLAR.

appearance, is strong, durable, and may be quickly adjusted to fit any size of head. As auxiliaries to the above appliances, ligatures made from waxed floss silk, or wire, are necessary.

CHAPTER II.

BANDS AND LIGATURES.

SECTION I. TEETH BANDS.

IN this system two kinds of bands are used for attaching the appliances to the teeth: the plain or soldered band (C, C, Fig. 2), and the clamp or adjustable band (Fig. 6). The plain band is made from the coil of band-material, F and H, Fig. 1. F is thinner and narrower than H, and is generally used on the lower incisors or upper laterals, or where a delicate band is desirable. It is extremely thin, being .003 of an inch in thickness, so that it will readily pass between the teeth and occupy but little space; yet the material is so strong that it will resist all necessary strain if not overheated. H is .004 of an inch in thickness, and is used in making the bands for the central incisors or cuspids. Each coil is sufficient for about twenty-five bands.

I have long discontinued the use of plain bands upon the molars and bicuspids, for it is impracticable to fix and cement them on these teeth (owing to their unfavorable shapes and positions), so that they will not soon loosen under the severe strain to which they are subjected.

The adjustable clamp-bands, Nos. 1 and 2, are far more convenient and desirable, being easily and quickly clamped and bur-

nished to fit the tooth so that they will not loosen, and cement is unnecessary, except in such combinations as shown in Fig. 17, where stationary anchorage is necessary. Another advantage is in their ready removal and replacement, should changes in their attachments be necessary.

These bands are made in two sizes, which have been determined by the accurate measurement of a large number of bicuspids and molars. They will fit all teeth of normal size, and may be enlarged to accommodate teeth of unusual size by beating the first third or half of the screw flat over the horn of an anvil; to reduce the size for abnormally small teeth it is only necessary to cut the band midway of the flat portion, lap the desired distance, and resolder.

In adjusting them to the teeth extreme care should be exercised not to crimp, tear, or injure them in any way. If there is not space to admit their passage, it should be provided. The nut should be loosened and the band enlarged to the approximate size, then with a pair of flat-nosed pliers the band should be carefully bent to take the form of the tooth, and, if properly shaped, may be easily worked over the crown to any desired point with the fingers alone, sliding beneath the festoon of the gum and not pressing upon it. *The band should never, under any circumstances, be filed or cut away to avoid contact with the gum.* Never be content to stop when the band is only one-half or two-thirds over the crown, as the entire strain is then borne by that partial portion of the band, and breaking or slipping off is almost certain when the nut is turned. Carefully work the band to exactly the position desired, then tighten the nut and burnish, alternately, until the fit is accurate. Burnishing is important not only to enhance the fit, but to harden and strengthen the material.

As the bands are so important in this system, and the making and fitting of the plain bands the most difficult part in the construction of any of the combinations, I would recommend that accuracy and care be observed in each step in the operation. First, in order to insure perfect uniformity in annealing, the coil of band-material should be heated and plunged in dilute sulfuric acid before cutting the wire ligatures encircling it. A loop in the band-strip is then slipped over the tooth to be banded, and worked up or down upon the crown to the exact point it is to occupy when completed. It is held between the thumb and finger, and tightly drawn around the tooth against the opposite side from which the union is to be made. While thus firmly held it is grasped between the flattened beaks of a pair of strong pliers, and pinched or drawn tightly about the tooth, a burnisher being applied at the same time

to make it conform still more accurately to the shape of the tooth. It is important that the beaks of the pliers should be *smooth* and fit together *accurately*. It is then removed and presents the appearance of Fig. 7. A piece of clean silver solder, about one-eighth of an inch square, wet with borax cream, is now placed between the jaws at the junction and held there by being pressed together with the delicate soldering pliers E, Fig. 8 A. It is then held over a fine, sharp soldering flame. When soldered, the inner surface of the band should present one continuous, even surface; any other union is imperfect and should not be used.

The band is now ready for any attachments which may be made, the untrimmed ends of the band serving the useful purpose of a handle for holding the band in the flame and in contact with the piece to be attached, while soldering, as in G and H, Fig. 21. After the attachment has been made the ends of the bands are trimmed off, leaving them long or short as desired.

Fig. 7.

If a niche is to be formed as in A, Fig. 21, or C, C, Fig. 2, the ends are left about one-sixteenth of an inch long; but if not to serve as a means of attachment they may be trimmed still shorter, though it is never desirable to trim them even with the surface of the band. These united ends may be further strengthened by an extra piece of the band-material held between the jaws at the junction when soldering.

It should now be boiled in a few drops of dilute sulfuric acid in a small test-tube or other suitable vessel, after which it is washed and dried. The tooth should now be protected from moisture by a small roll of cotton or bibulous paper, the surface of the tooth cleansed by a pledget of cotton moistened with alcohol or ether, and dried with the chip-blower. A sufficient quantity of oxyphosphate of zinc to fill the band is now mixed to a creamy consistence, then carried on the end of the finger to the tooth, forcing the cement, as well as band, on to the tooth. By carefully working with the fingers alone, the band is forced nearly to its desired position, which may be completed by a few gentle taps from the mallet and band-driver (L and M, Fig. 8 B). The burnisher is now quickly applied and the surplus cement wiped off. If the operation has been carefully performed the band will fit with the most

glove-like accuracy at every point, so that it will occupy the least possible space, which is very desirable in most cases. The attachment will be so firm that the annoyance of loosening will be obviated. Only a perfectly-fitting band can be firmly attached. If the band is defective in any particular, as too large, weakened by crimping, or slightly torn when driven in position, it should be immediately condemned, and a more perfect one substituted, for sooner or later it will surely fail and cause annoyance.

It is most important that the operation of banding should be thoroughly performed, and at the first operation, or before the tooth has become tender by being moved.

In making the band, it is desirable that all the attachments which will be needed, both in moving and retaining, shall be added before first setting the band, in order that the subsequent pain and trouble of loosening and resetting may be avoided.

A little experience (and I would recommend also practice upon teeth out of the mouth) will soon enable the operator to quickly, easily, and perfectly band any tooth.

In cases where the teeth are crowded firmly together, leave the band in position upon the tooth for a few hours, or over night, before finally cementing. Sufficient space will thus be gained so that the band may be readily cemented without crimping.

A cuspid is the most difficult of any of the teeth to band, but by forming a seam on the lingual slope and firmly burnishing the outer surface while it is being pinched, an accurate fit can in most instances be made; or, by making the union on the labial surface, and pinching a fold on the lingual slope and again soldering, an accurate fit may be obtained.

After a band has been set, and the cement thoroughly hardened, the band should be carefully polished and burnished, as it is well known that discoloration is less liable with a smooth, polished surface than a rough one. I have found nothing nearly so effective for removing the superfluous cement and polishing the surface of the band as little leather polishing-wheels.

When desirable to loosen the band, never attempt to do so with forceps, as the shock to the tooth and danger to the enamel are too great to be risked. Cut the band by grinding it with a suitably-shaped wheel, carefully supporting the tooth at the same time.

Section II. Ligatures.

Of the various materials employed for ligatures I now use but three. First, the rubber ligature, which is best made by punching with a rubber-dam punch a hole through heavy rubber-dam, or in a thin elastic band, and then trimming the outside down to the desired size; second, waxed floss silk; third, wire. Each possesses advantages in certain cases, but on account of the cleanliness, strength, and ease with which force may be exerted by twisting its ends, the wire ligature is decidedly preferable. The proper sizes of wire are *Nos. 26 and 28*, and it should be annealed brass. It may be procured of any wholesale hardware dealer, or will be supplied if desired. Spring wire will not answer.

The best way to adjust a wire ligature is to cut a piece from the spool, eight or ten inches long, or sufficient to be grasped firmly with the hands. It is made to encircle the tooth and arch by passing it through the interdental spaces. The ends are grasped firmly, drawn around the tooth and appliance, and twisted, —never more than three-quarters of a circle at first. The surplus wire is then cut off with the shears (C, Fig. 8 A), leaving the ends one-eighth of an inch long, then curling them around under the arch, as shown correctly only in Figs. 28, 67, and 73. It is very important that this point be remembered, for by observing this special way of providing for the sharp ends, a smooth, easy surface is presented to the lip. Never attempt to bend the twisted portion of the ligature out of the way, as by so doing the ligature will, in almost every instance, be broken. In tightening the ligature, I find a very excellent plan is to gently press the tooth and arch between the roughened beaks of pliers B, Fig. 8 A, while the twist is being made with pliers A, Fig. 8 A. Great force should never be exerted in twisting the wire, or breaking will surely follow. It should also be remembered that the spring of the wire arch, when used in connection with the wire ligature, is constantly acting, so that as a rule tightening a ligature should be done only occasionally.

The different styles of ligatures are well shown in Fig. 28, and should be carefully studied.

FIG. 8 A.

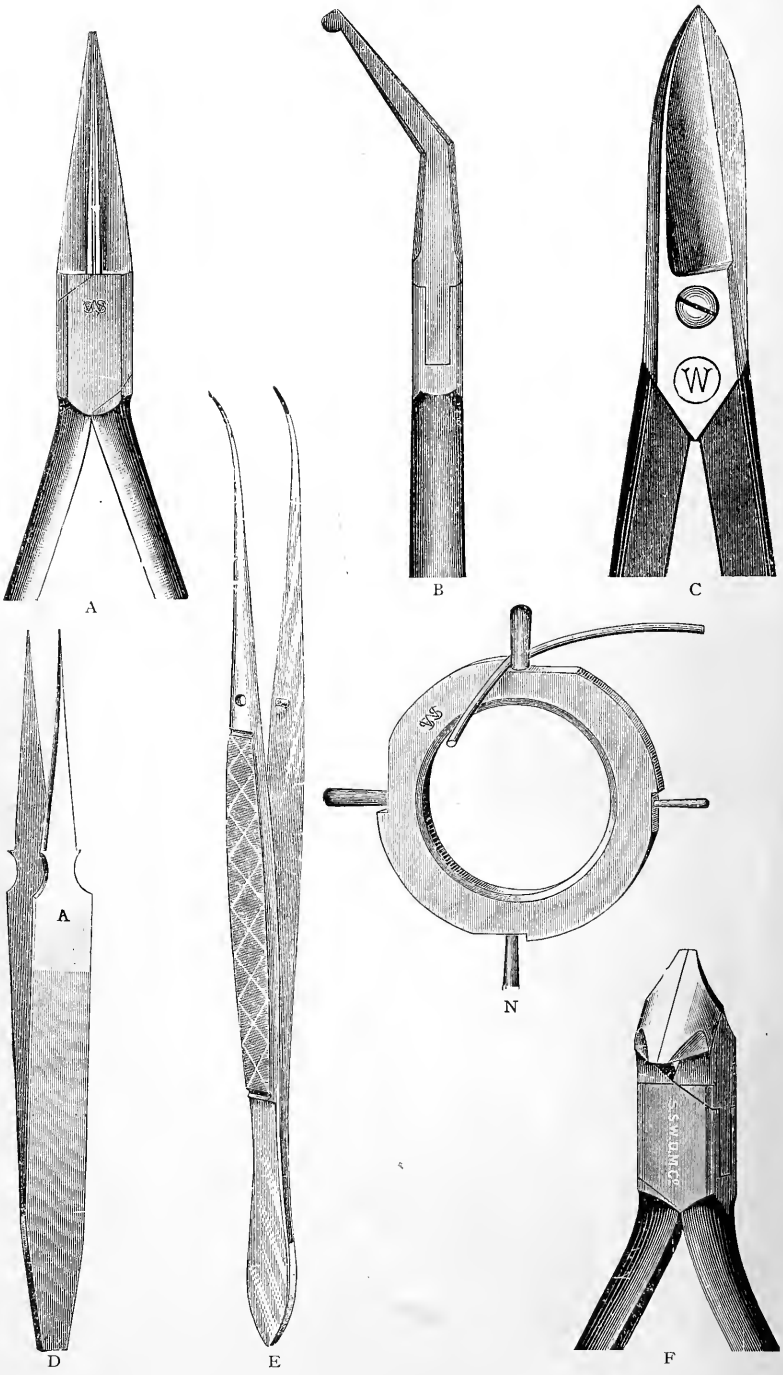
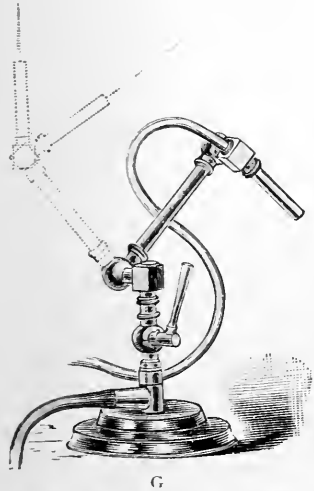
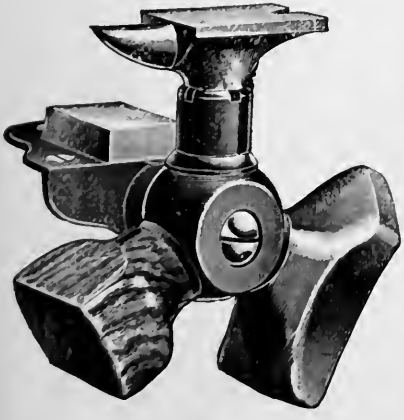


FIG. 8 B.



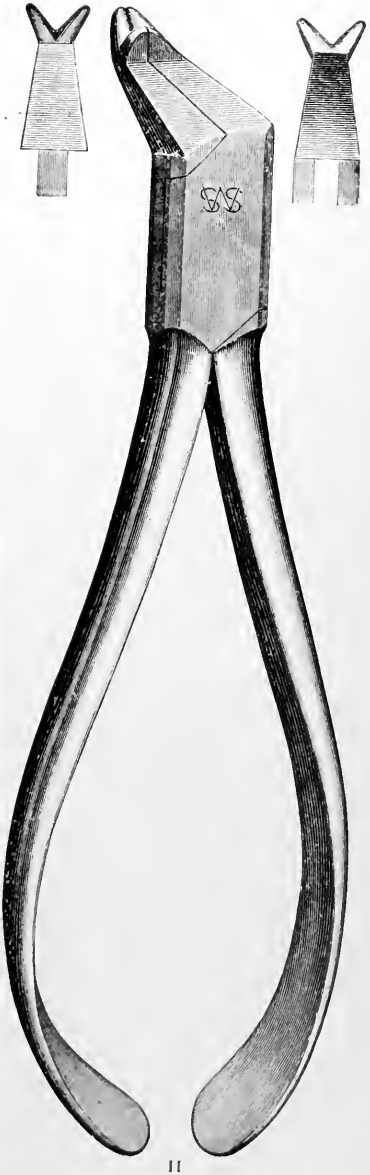
G

L



K

M



H

CHAPTER III.

TOOLS.

For uniting the different parts of the appliances to form the various combinations, and placing them in position upon the teeth, only a few tools are necessary, but it is important that they should be of the best selection. A pair of shears, C, Fig. 8 A, for trimming soldered bands and cutting wire ligatures, etc. A pair of pliers, E, Fig. 8 A, used in holding bands and some of the small parts while soldering, is the most suitable of any made, on account of their fine, delicate proportions. Coarse pliers should never be used, as they absorb too much heat, and with them fine, delicate soldering cannot be accomplished without danger of overheating.

A second pair, D, Fig. 8 A, for placing pieces of the solder in position. A pair of wire-cutters; I prefer the style shown in F, Fig. 8 A.

Two pairs of pliers for forming the plain band, twisting wire ligatures, etc. Those shown at A and B, Fig. 8 A, are most excellently adapted.

H, Fig. 8 B, shows the author's forceps for stretching wire, which will be found very useful in the regulation of teeth. Its peculiar form renders it easy of application in any part of the mouth. It is adapted to the wire G, Set No. 1, and should never be used for stretching hard or large-sized wires. A little experience in its use, and the operator will become skillful, and will probably be surprised to see how much can be accomplished in the regulation of teeth by its use. A little anvil is also quite useful, and the very handy and ingeniously constructed pattern shown at K, Fig. 8 B, will be found the most suitable.

CHAPTER IV.

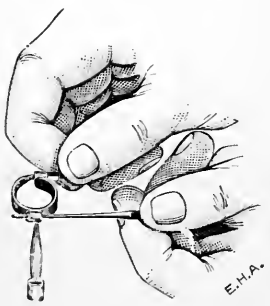
SOLDERING.

In uniting the parts of the appliances with solder, a fine, sharp flame from a stationary, self-acting blow-pipe is most desirable, as then both hands are free and can be used in holding the pieces. Notwithstanding many ingenious spring-clamps and devices have

been invented for holding such small work while soldering, yet I greatly prefer holding them with the fingers, as it is so much easier and simpler, steadying the hands by touching the fingers together, as shown in Figs. 9 and 10.

The metal of which these appliances are made is most favorable for soldering in this way, it being so extremely poor a conductor of heat that all such attachments as E, F, I, H, and K, Fig. 20, can readily be held with the fingers without hardly noticing a change in the temperature, provided the flame is suitable. I prefer the Herapath blow-pipe, as shown in G, Fig. 8 B. A building where compressed air is furnished and conducted through pipes to all rooms, the same as gas, the pressure being constant, even, and steady, is preferable; yet the ordinary foot-bellows answers very well.

Fig. 9.

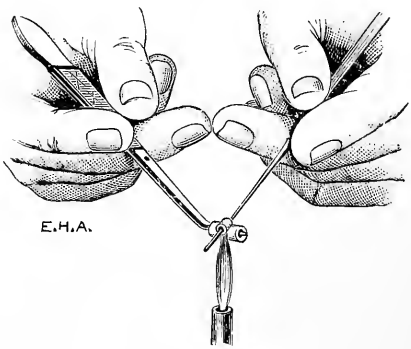


All the small tubes are best held by slipping them on to the end of an excavator shank or, what is just the ideal, one of Gates's nerve-drills after the cutting-point has been broken off. It is so slender that but little of the heat is absorbed. Two of these handles may be employed when a couple of the small tubes are soldered, as R, C, Fig. 44, or the pliers may be used for holding one of them. (See Fig. 10.)

I should judge it not difficult to learn this method of soldering, as most of my students seem to learn it readily. The only point which at all may perplex the beginner is to hold the pieces immovable just at the time solder is congealing, but this can be done by touching the fingers of the opposite hand in order to steady and prevent all motion at the point of union, and at the same time holding the pieces gently, not rigidly, just as a good penman holds a pen. After a little practice any of the combinations shown in this book may be easily made in a very few minutes. All of the

various attachments by solder shown in Figs. 20 and 21 are made in this way. In such attachments as E, F, H, and K, Fig. 20, the pieces of solder may be kept from flying off by gently holding them in position between the pieces to be united. But where the ends of small tubes are to be secured as in C and D, it is best to first use the solder upon the band, and then hold the small tubes by means of the soldering pliers in contact with the solder and again apply heat, otherwise the solder will be drawn into the tube. The solder best adapted in uniting the different parts of these appliances is the ordinary jeweler's silver solder, although any of the gold solders work equally as well. Plenty of borax should

FIG. 10.



always be used as a flux. Never use more solder than is necessary, especially in attaching the small tubes; use just sufficient to make the union.

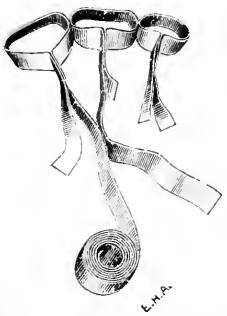
Always avoid overheating; just enough heat from a small flame to thoroughly fuse the solder is all that should ever be employed. In every instance, avoid heating the screws or nuts. This is to be especially observed with the jack and traction-screws, as great care is observed in their manufacture to produce the greatest stiffness and strength, and this fine temper is ruined by heating. The wire arches B and E are also manufactured in such a way as to give to them the greatest possible spring, second only to steel. They must not be heated, or this delicate temper will be destroyed.

The three delicate sheaths found on the wire arch B, Set No. 2, are attached by means of soft solder. Should one of them become loosened it may be resoldered, using the soft solder and a drop of muriatic acid, and applying a fine flame, carrying the heat to only just the point sufficient to fuse the solder.

Where two or more bands are to be united in order to retain the

teeth, as in Fig. 54, they should be gently held by their untrimmed ends while being soldered, as in Fig. 11, after which they are trimmed with the shears.

FIG. 11.



CHAPTER V.

IMPRESSION AND MODEL MAKING.

IN deciding upon the proper course of treatment in any given case, it is of the first importance to obtain very accurate articulating models of both arches. Such models not only assist in forming a basis for correctly establishing the proper line of operation, but are exceedingly valuable as references during the whole course of treatment, for from such models accurate measurements may be taken from time to time, and comparisons be made as the case progresses. In this way one may not only judge of the exact speed of the moving teeth, but any unfavorable movements of the anchor teeth may be detected.

In order that these models may be of real value, they must not only accurately show both arches and the relative positions of the teeth and cusps, and also the vault of the arch, rugæ, and gums, but must correctly show as much of the roots and positions of the same, as indicated by the gums and alveoli, up to the point where the attachments of the muscles render obscure the further shape of the jaw. Such models can only be made from impressions taken in plaster.

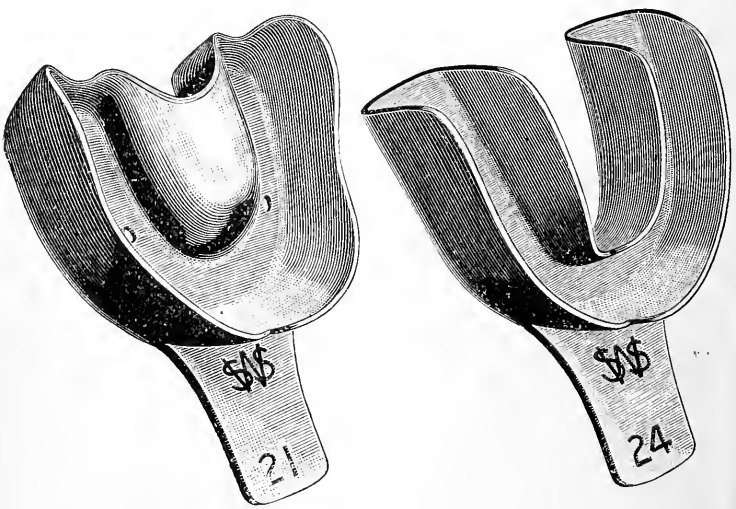
From the large number of imperfect models which I receive each year from dentists, I am of the opinion that the value of correct models is not sufficiently appreciated.

If the reader will carefully follow the following simple plan for taking impressions and making models he will find, after a little experience, that the method is both natural and easy, and the most beautiful results certain. He must, however, observe accuracy in each stage of the operation.

First, the teeth should be thoroughly cleansed from all tartar or soft deposits. For this the little rubber cup disk used with pumice is most excellent. Care should be taken not to wound the gums, as any bleeding prevents accuracy of impression.

The trays shown at Fig. 12 are essential. They were especially designed for taking impressions of complete or partial arches, and must always be kept thoroughly smooth, bright, and clean.

FIG. 12.



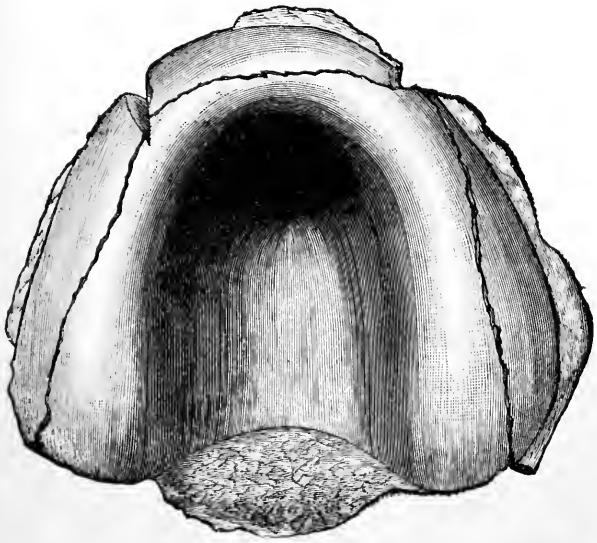
AUTHOR'S IMPROVED IMPRESSION-TRAYS.

Good impression plaster is mixed in the usual way and carefully distributed, as shown in Fig. 13½, the shape and height of the trays making but little impression-material necessary.

It will be observed that the greater amount is placed in the anterior part of the tray and made to extend over the outer edge of the rim, none being allowed in the vault of the tray. It is now placed in position and allowed to rest evenly in contact with the cutting edges of all the teeth. The lip is then raised and the plaster extending outside the rim is carried high up underneath it *with the finger;* then the tray is forced up evenly until the points of the teeth touch, or nearly touch, the bottom of the tray, and

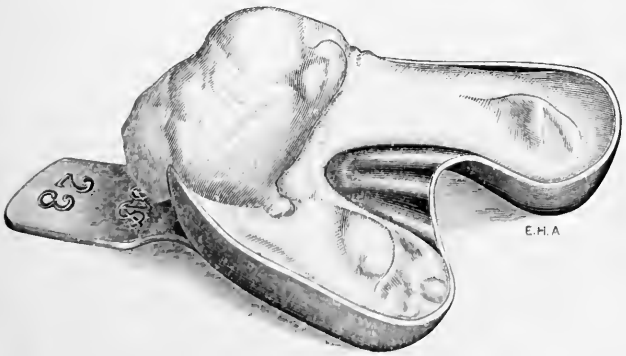
steadily supported on the end of the index finger only. To expel the air, the lip and cheeks are now gently manipulated, but not drawn down, as to do so would expel a portion of the plaster and prevent one of the important objects, viz, a very high impression.

FIG. 13.



As no surplus plaster could have been forced in contact with the soft palate, causing nausea, the patient will not be inconvenienced, and the impression may, therefore, be allowed to remain until it has

FIG. 13½.



become thoroughly set. The harder the plaster is allowed to set the more perfect will be the impression. (If removed too quickly, portions of the plaster will be found adhering to the surfaces of the teeth.)

The tray must now be loosened and taken away, leaving the impression in the mouth. All superfluous pieces should be removed very carefully. Two grooves are then scraped or cut in the hardened plaster on a line parallel with the cuspid teeth, never, however, cutting quite through. Then, with a quick pry with the point of a pen-knife, the anterior plate is wrenched loose and laid, together with all subsequent pieces, on a clean blotting pad. The lateral pieces are then broken off between the thumb and finger, when the large piece covering the roof of the mouth alone will remain. This may be readily worked loose, and, if the operation has been carefully performed, the impression will then consist of four pieces (although a greater number will in no way injure it). Great care should be observed to save all small pieces, removing them as clean as possible.

Patience and care should be observed in re-uniting the pieces. If skillfully done the line of fracture can hardly be detected. The pieces are best united out of the tray and held with wax made quite hot on the spatula and flowed over the outside, the clean, united ends being held so perfectly in contact that little if any will flow into the fracture. When finished it should have the appearance illustrated in Fig. 13. If there be an unusual number of pieces they may be united by replacing them in the tray, but this is never very accurate, as the expansion of the plaster makes a perfect fit with the tray impossible.

This method of taking impressions preserves the fine points of the interdental spaces. I believe it to be the only practicable way of taking an accurate impression.

In like manner the impression of the lower arch is secured, being careful to observe the essential points, namely, carrying the impression-material, which has been built up and outside of the anterior part of the rim, well down beneath the lip *with the finger* before forcing the tray home, then expelling the air by gradually working the cheeks while the tray is firmly held. Care should be observed in selecting a sufficiently large tray which may, without injury, be bent to conform more perfectly to any peculiar shape of the arch.

After the impression has been thoroughly dried the inside should be coated with shellac varnish; at the expiration of half an hour it is again coated with sandarac varnish, and at the end of another half-hour it should be very carefully filled with plaster.

It is important that both of these varnishes shall be of the proper consistence, which it is difficult to describe. If too thin it will be

difficult to separate the impression without injury to the model. If too thick all fine tracings of the impression will be obliterated. The proper consistence is best determined by a little experience.

The filling of the impression with plaster is best accomplished by applying the soft plaster into the tooth cavities by means of a small camel's-hair brush in order to expel all air-bubbles, then filling the remainder by means of the spatula; then it should be turned upside down on a glass slab.

After the plaster has thoroughly set, the pieces of the impression may usually be very readily separated in the same order in which they were removed from the mouth, when, should any air-cavities be found in the model, they may be beautifully filled by packing in white oxyphosphate of zinc and pressing it home by replacing the piece of the impression, which should be allowed to remain until the cement is thoroughly hardened, when it will readily separate, leaving a very perfect surface. A cusp or broken tooth may in like manner be repaired.

The models may now be trimmed, and not only will there be a surface as smooth as polished marble, but each cusp, all the interdental spaces, the rugæ as well as the inclination of the roots, and even the minute "stipples" of the gum, will all be accurately and beautifully shown. Any coatings of paints or varnishes only detract from the beauty of such models.

They should now be carefully articulated, after comparison with the natural teeth and the articulation, indicated by two or more pencil markings, so the proper points of contact may be afterward readily found. These serve the purpose quite as well as a metal articulator. The models should also be neatly labeled to serve for study and reference, and, on occasion, be valuable as legal evidence.

As soon as the teeth have been completely moved, another impression should be taken and models made. This is done after all appliances have been removed, the teeth thoroughly cleansed, and immediately previous to adjusting the retaining appliances. These models are valuable for comparison with the natural teeth during the period of retention, as well as for future reference.

It is also of advantage to have study models occasionally made during treatment and retention, by pressing a piece of softened wax, about three-eighths of an inch deep, onto the cutting edges of the teeth, to accurately show the positions of the teeth only, together with such appliances as may be upon them.

CHAPTER VI.

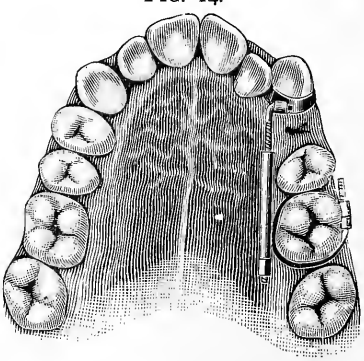
DIRECTION OF FORCES FOR TOOTH-MOVEMENT.

In the correction of dental irregularities, an appliance must act either by pulling, pushing, or twisting a tooth into proper position; and the movements of the tooth are limited to seven: backward or forward in the line of the arch, outward or inward in the line of the arch, elongation or depression of the tooth in its socket, and rotation.

Section I. Backward in the Line of the Arch.

The backward movement of the teeth in the line of the arch is accomplished in two principal ways. First, by the large traction-screw A and D, Set No. 1, shown in Fig. 14, for the retraction of a

Fig. 14.



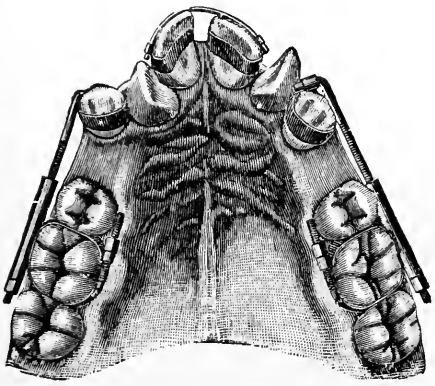
Retraction of Cuspid.

superior cuspid. The first molar is encircled by a No. 2 clamp-band (Fig. 6), to which is soldered the long sheath of the traction-screw A, Fig. 1. The cuspid is also encircled by a band, having the short tube D, Set No. 1, soldered horizontally to it on its distal surface, with which tube the smooth bent end of the traction-screw engages. The nut, operating against the distal end of the tube, will move the cuspid backward into position. The easiest way to adjust this appliance is to first cement the band upon the cuspid; after the cement has become thoroughly set, the angle of the traction-screw is hooked into the short tube, and the adjustable band latched over the molar. It is very important that the bent end be passed into the tube its *full length*, otherwise it will be broken when force is exerted. The screw may be employed on the

outside of the arch; the short tube, in that event, should be attached to the mesio-buccal angle of the band, as shown on the right cuspid of Fig. 15.

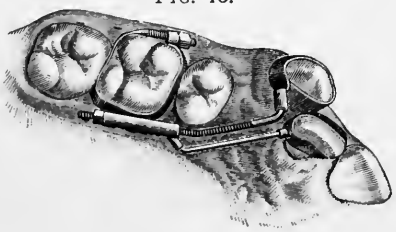
If a movement of rotation as well as retraction is desirable, the angle of the screw should be hooked over a spur, as shown on the

Fig. 15.



left cuspid of Fig. 15, thus concentrating all the force upon one side of the moving tooth. Recent experience has shown that a staple made from the wire G, Set No. 1, is stronger and better than the spur for making this attachment. Should the cuspid be very prominent, requiring the movement to be inward as well as backward, that may be accomplished at the same time by bending the screw, which, as the nut is turned, will be gradually straightened. (See Fig. 16.)

Fig. 16.

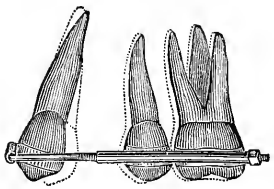


A method of reinforcing the anchor-tooth is also shown in this engraving, by enlisting the resistance of the lateral incisor. This tooth is banded and provided with one of the pipes R, Set No. 1, soldered to its distal angle; one end of a piece of the wire G, Set No. 1, is soldered to the sheath of the traction-screw, and made to rest in this pipe.

In making the attachments for retraction after the manner de-

scribed, it is of the utmost importance that the band encircling the molars should be tightly clamped, burnished, and firmly cemented, so that the attachment will be perfectly rigid. In this way the resistance of the anchorage will be greatly increased, and tipping of the anchor-teeth will be prevented; while, if moved at all, they must be dragged bodily through the alveolus, because the apices of the roots move equally with the crown, as shown in Fig. 17,

FIG. 17.

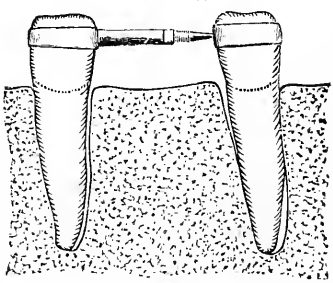


STATIONARY ANCHORAGE.

which represents a side view of the appliance in position, the dotted lines showing the movements which must take place if the attachment is properly made. This is a most perfect form of anchorage, and I am indebted to Dr. W. C. Barrett for first suggesting it.

If the nut is placed upon the screw in front of the sheath and tightened, force with the same resistance of anchorage may be

FIG. 18.



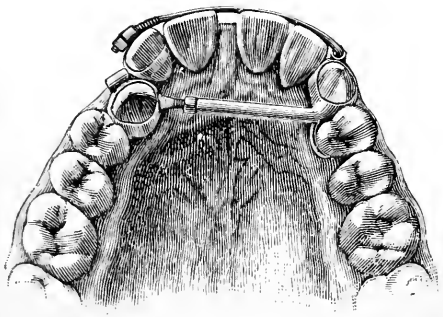
exerted in moving the tooth forward instead of backward. When the jack-screw is employed for pushing, the same firmness of anchorage may be gained by soldering the base of the sheath to the anchor-band, which is to be firmly clamped and cemented in position upon the anchor-tooth, as shown in Fig. 18.

Another way of moving teeth backward in the line of the arch is by means of Set No. 2, and will be described in the treatment of cases of excessive protrusion of the superior incisors.

Section II. Forward.

The movement of a tooth forward in the line of the arch may be accomplished by means of the traction-screw, in the same way as already described for retraction, by selecting anchor-teeth on the opposite side to be used in overcoming the resistance of the tooth that is being moved, as shown in Fig. 19, which represents

Fig. 19.



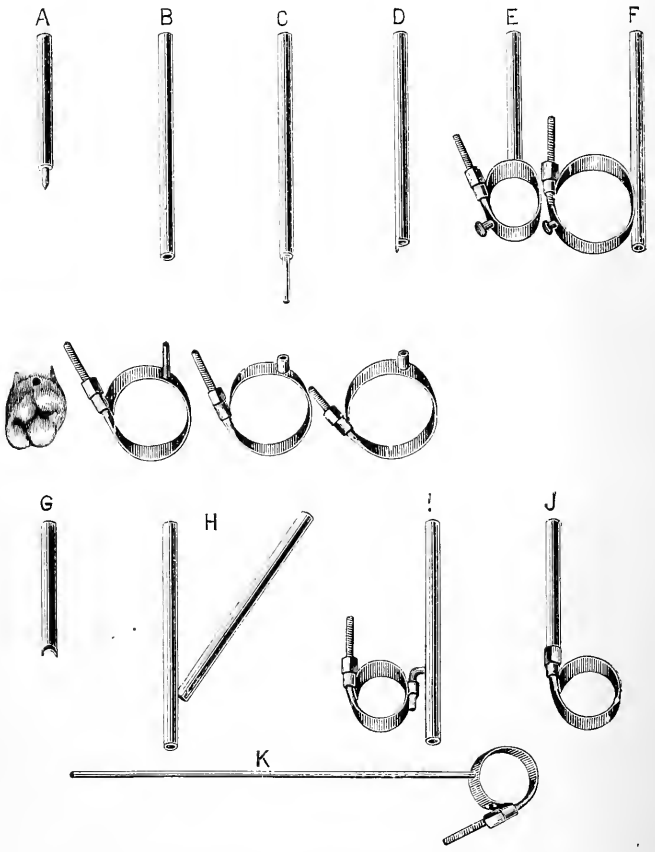
a case in practice, and shows the screw employed in pulling both incisors forward in the line of the arch to close the wide space between the centrals; at the same time providing space for the cuspid, which is being moved out of inlock by means of the jack-screw. In this case the traction-screw was beaten flat, polished, and bent to conform to the curve of the arch.

Section III. Outward.

The movement of a tooth from within outward into the line of the arch is accomplished in four principal ways: First, by means of the jack-screw E and J, Set No. 1, the sheath of which is secured to a suitable anchor-tooth, the point acting upon the moving tooth by turning the nut. The base of the sheath of the jack-screw may be secured in various ways, as shown in Fig. 20. First by a dowel made by soft-soldering a piece of the wire G, Set No. 1, into the end of the sheath which rests in a pit in the anchor-tooth, as in A. By a spur made from the same wire soldered to the anchor-band, over which the end of the sheath is slipped, as in B. By a dowel made from the same wire, slipped into one of the pipes R, Set No. 1, soldered to the anchor-band, as in C. (In this way the length of the sheath may also be increased.) By pointing the end of the sheath with a file and letting the point rest in the pipe on the anchor-band, as in D. By soldering the sheath directly to the anchor-band, as in E and F. By notching the end of the sheath,

which shall engage the anchor-wire as in G, Fig. 20, and Fig. 41. By soldering the end of the sheath directly to another sheath, as in H. By means of a spur made from the wire G, Set No. 1, soldered to the sheath which shall engage one of the pipes R, Set No. 1, soldered to the anchor-band, as in I. By slipping the end of the sheath over the screw upon the clamp-band, as in J. Of these

FIG. 20.

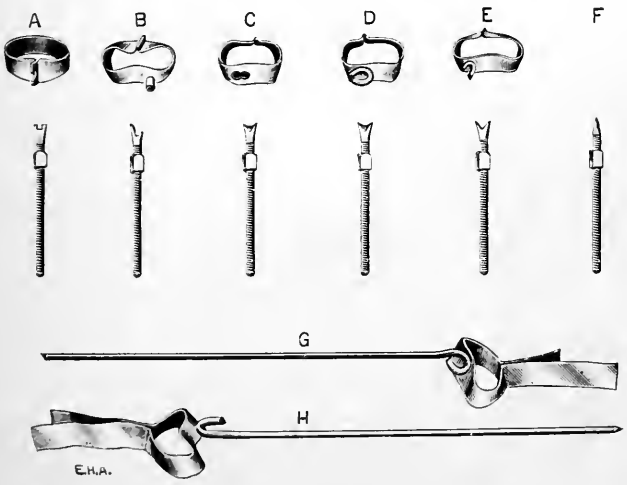


various ways I prefer that of attaching the sheath directly to the anchor-band, as in E and F, or by means of the spur, as in B (the spur being quickly and easily made by soldering), by holding a long piece of the wire G, Set No. 1, between two of the fingers of one hand, while the end of the screw upon the clamp-band is grasped between the thumb and finger of the other hand, carrying it in contact with the fine point of the flame (as in Figs. 9 and 10), presenting the appearance after soldering shown in K, Fig. 20;

after which the wire is cut off, leaving the desired length of the spur. The point of the screw is held firmly in position by six principal ways, as shown in Fig. 21.

First: By notching the point of the screw with a separating file, which notch will engage a similar notch in the united ends of the band, as in A. By pointing the end of the screw to engage one of the small pipes R, Set No. 1, soldered to the band as in B. By a mortise in the band to engage the point of the screw, as in C. By soldering an elliptical ring (formed by bending the wire G, Set No. 1, as at G, Fig. 21), in which to rest the point of the screw, as in D. By a staple, made from the same wire, soldered (see H) to the band, as in E, the point of the screw being suitably notched.

FIG. 21.



By pointing the screw to be received in the pit formed in the enamel or filling, as in F. Of these various ways of securing the point of a jack-screw, I prefer the plan shown in D and E, forming the ring and staple upon the ends of long pieces of the wire, which serve as handles while soldering, as in G and H, after which the superfluous portions are clipped off. The roughened ends are then rounded and made smooth with a fine file.

Fig. 22 shows an inlocked cuspid being moved outward, the point of the screw resting in a mortise formed in the band upon the moving tooth, the base of the sheath being notched to engage a piece of the anchor-wire G, Set No. 1, passing through a tube soldered to the lingual surface of the left cuspid. The anchorage is greatly reinforced by means of this wire, which is beaten flat where it passes between the central and lateral, the end being

bent around the labial surface of the central. Force is obtained by turning the nut. After a tooth has been moved into the desired position, it is retained by a piece of the wire G, Set No. 1, passed through a pipe R, Set No. 1, soldered to the band, the wire ends resting upon the labial surfaces of the lateral incisor and

Fig. 22.

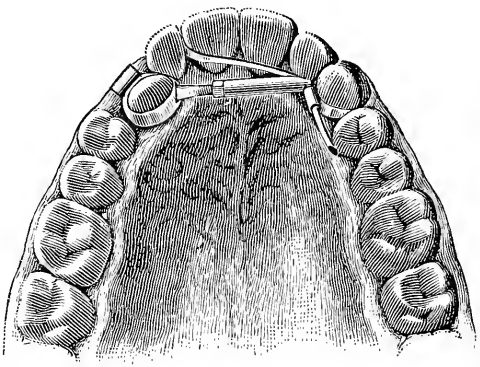


Fig. 23.

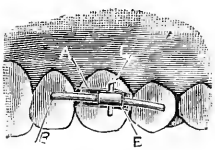
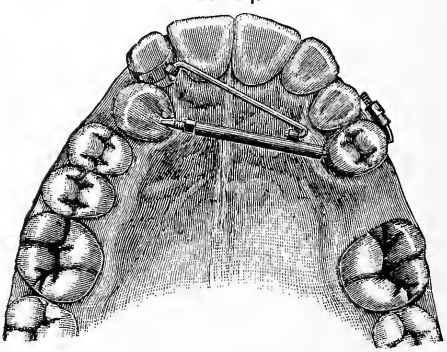


Fig. 24.



first bicuspid. This wire is held in place by a very delicate pin passing through the pipe and one side of the wire, as in Fig. 23.

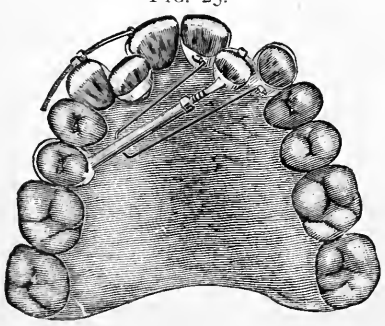
Fig. 24 shows a favorite method of reinforcing the anchorage. In this case the sheath of the jack-screw was placed on a spur soldered to a bicuspid clamp-band, as at B, Fig. 20. The point of the screw was sharpened and rested in a pit formed in the

enamel. Reinforcement was gained by hooking a piece of the wire G, Set No. 1, into two pipes (R, Set No. 1), one soldered to the sheath of the jack-screw near its base, the other soldered to the lingual surface of a lateral incisor band. If the appliance has been carefully adjusted the patient may be provided with a wrench, and instructed in turning the nuts at proper intervals.

Recent experience has proven that an easier way of attaching the reinforcement wire is to omit the pipe attached to the band on the lateral, soldering the straight end of the wire directly to the band. The other end of the wire should be passed straight through the pipe, on the sheath, and secured by bending the end around the pipe end.

Fig. 25 shows a left lateral being moved outward, reinforcement having been gained in the manner already described, using two

FIG. 25.



pieces of wire attached to bands on the central and cuspid. Not only was the anchorage reinforced, but the incisor and cuspid were prevented from being pushed out, the moving tooth providing space for itself by forcing the adjoining teeth laterally. By this means the most perfect form of anchorage is secured, employing, preferably, the method of attaching the reinforcement wires described in the last case.

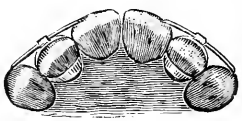
The second mode of moving a tooth from within outward is shown in Fig. 25, where a right lateral is being forced outward by means of the small traction-screws B and C, Set No. 1. A strip of the band-material (F, Set No. 1) is looped around the lateral, the ends resting upon the labial surfaces of the adjoining teeth. On one end is soldered a short tube, C (accompanying the screw), attached vertically, while on the other end a similar tube is attached horizontally. Into these tubes the traction-screw B, Set No. 1, is placed, being bent to conform to the circle of the arch, and used, in this case, to push instead of pull. This appli-

ance should be frequently tightened by turning the nut, or it will become loose and cause trouble. The parts of this device are shown separately in Fig. 26.

Fig. 27 shows the teeth as retained by means of pieces of the anchor-wire (G, Set No. 1) passing through pipes attached to the labial surfaces of the bands, as described and shown in Fig. 23.

Fig. 26.

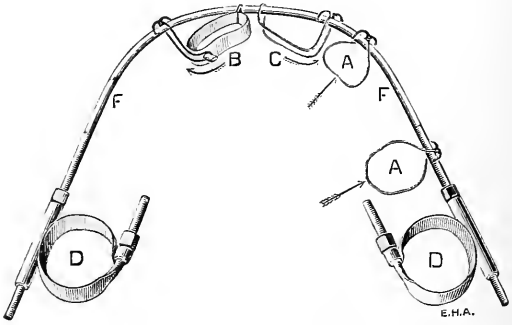
Fig. 27.



The third method of moving a tooth from within outward is by lacing the teeth to the expansion arch, as in Fig. 28, force being derived from the spring of the arch and sustained by occasionally turning the nuts. (See also Fig. 68.)

The fourth method is by means of the wire ligature encircling the tooth and arch, force being exerted by occasionally twisting the wire, as in A, A, Fig. 28.

Fig. 28.



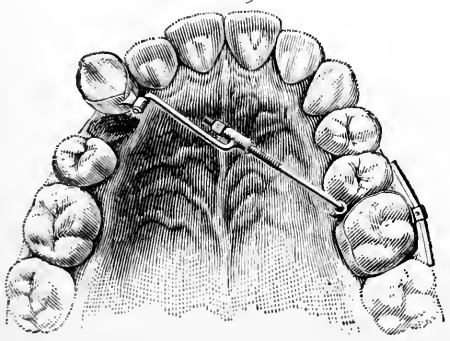
Section IV. Inward.

A tooth may be moved inward by the small traction-screw B and C, Set No. 1, as shown in Fig. 29, in which a cuspid is being drawn into line, the bent end of the screw being hooked into the small tube C, Set No. 1, soldered to the band upon the anchor-tooth. The other end of the screw passes through a similar tube, against the end of which the nut works. To the tube is soldered a piece of the wire G, Set No. 1, bent at right angles and hooked into a pipe (R, Set No. 1), soldered to the lingual surface of the band on the cuspid. Force is exerted by turning the nut. The anchor-tooth was reinforced by a piece of the wire G, Set No. 1, resting in contact with the buccal surfaces

of the adjoining teeth, and held in position by one of the small pipes R, Set No. 1. This anchor-wire was kept from turning by a very delicate pin passing through the pipe and one side of the wire, as in Fig. 23. Another way of securing this wire is by soldering it directly to the band.

Prominent teeth may also be forced into the line of the arch by means of the wire arch B, Set No. 2, or the expansion-arch E, Fig. 4, made to encircle the dental arch and bear against the prominent tooth, and the force may be intensified by an intervening wedge of rubber. The adjoining teeth are firmly laced to the arch by means of wire ligatures, as described in the treatment of the case shown in Fig. 65.

Fig. 29.



Section V. Rotation.

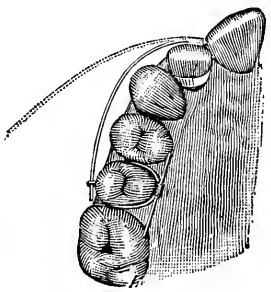
There are three principal modes of rotation by this system. First: by means of the lever, band, and tube, as shown in Fig. 30, which represents a lateral incisor in process of rotation. The incisor was encircled with an accurately-fitting band cemented in position and having soldered to it one of the small pipes R, Set No. 1, into which was inserted the end of one of the levers L, Set No. 1, the other end being sprung around and secured to a suitable anchor-tooth. This attachment of the end of the lever may be made in various ways,—either by being latched into a notch formed in the united ends of the band as shown in Fig. 30, or by a wire ligature made to encircle the anchor-tooth and lever, or by a wire ligature encircling the button on the clamp-band (No. 3 or 4, Fig. 6), and attached to the end of the lever bent in the form of an eye; which is now my favorite method. The anchor-tooth may be reinforced by a piece of the wire G, Set No. 1, resting in contact with the lingual surface of the adjoining teeth, and held in position by one of the pipes R, Set No. 1, soldered to

the anchor-band as shown. It will be seen that thus a constant, powerful, rotative force may be exerted upon the tooth.

Care should be exercised that the lever be not allowed to pry against the intervening teeth, to force the tooth outward.

It is often desirable to lace one or more of the intervening teeth to the lever by means of the wire ligature, to prevent overlapping of the teeth. The leverage may be increased by allowing

FIG. 30.



ROTATION.

the end to pass through the pipe, and to bear against the labial surface of the adjoining tooth. This may be intensified by an intervening wedge of rubber.

Fig. 31 shows the rotated incisor retained by a short piece of the wire G, Set No. 1, slipped into the pipe from the opposite side and made to bear against the labial surface of the central incisor. There should also be soldered a spur to the disto-lingual angle of the band and made to bear against the cuspid.

FIG. 31.

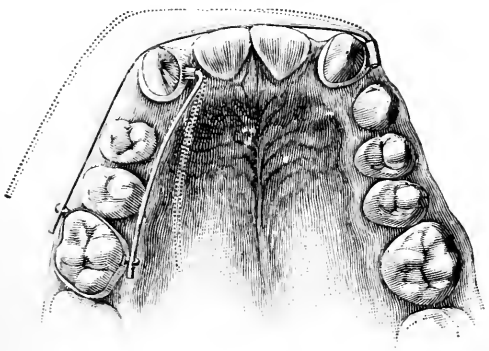
RETAINER.

Fig. 32 shows two cuspids being rotated by this method. It will also be seen that the lever may be employed on the inside of the arch, and in this case there was the advantage of reciprocal anchorage resulting from the ends of the levers acting in opposite directions upon the anchor-tooth.

In all similar cases where the lever is being employed on the outside of the arch it should be bent at the point nearest the labial surface of the cuspid, so as to concentrate all the spring in the region of the moving tooth.

Second: Rotation may also be performed, as shown in Fig. 33, by means of the jack-screw E and J, Set No. 1, secured by staple, clamp-band and spur, and pushing against one side of the tooth to be moved, while the small traction-screw, attached by pipe R, Set No. 1, and piece of anchor-wire G, Set No. 1, soldered to the

FIG. 32.



base of the sheath of the jack-screw, is made to pull upon the other side of the tooth. In this way perfect control of the tooth is gained, not only in rotation, but also in pushing it outward or pulling it inward into the line of the arch, according as the nuts are adjusted. This method of rotation is principally limited to the

FIG. 33.

superior central incisors or cuspids. It should be said that because of the powerful force they exert the nuts should be turned but slightly at each sitting. This is also another instance where use is made of reciprocal anchorage, which is to be taken advantage of whenever possible.

Third: Rotation may be accomplished by exerting force on one side of a tooth by means of a wire ligature on the expansion-arch E, and a spur soldered to a band encircling the tooth to be moved, as at B, Fig. 28. This force may be intensified by a wedge of rubber stretched between the band and arch and acting upon the opposite side of the tooth, as in Fig. 68. A modification of this plan of rotation is shown at C, Fig. 28, in which the band is dispensed with and the double or loop ligature is continued around the tooth, including the wire arch. This plan is less certain on account of the liability to slip: it is also less powerful, since the wedge of rubber cannot be used. It, however, will be found useful where teeth are to be but slightly rotated. At the same time a number of other teeth should be ligatured to the arch to secure greater firmness.

Section VI. Double Rotation.

When two teeth are to be rotated in opposite directions at the same time, as the central incisors shown in Fig. 34, double rota-

Fig. 34.

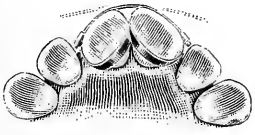
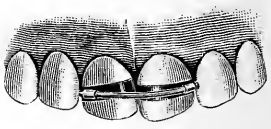


Fig. 35.



Double Rotation.

tion may be accomplished by a single lever. In this instance both the teeth are banded, and a tube soldered to each band. A straight lever is inserted in one tube, springing and sliding it into the other tube in the same manner in which a door-bolt is slid into position, as also shown in Fig. 35. It may be necessary to occasionally remove and straighten the lever a little, in order to maintain the pressure. Should one tooth be rotated sufficiently before the other, further movement may be arrested by removing the band and soldering a lug on the lingual surface to rest against the lateral incisor. And should the teeth in rotation assume too much prominence, by reason of pressure from the adjoining teeth, it may be effectually corrected by requiring the patient to wear, for a few nights, the head-gear, traction-bar, and heavy elastic bands shown in Figs. 2 and 3, filing a deep notch in the end of the standard to engage the rotating lever.

If the teeth show a tendency to separate as they rotate, they should be drawn tightly together by a ligature, made to encircle

both tubes and held in position by the ends of the lever, slightly protruding through the tubes.

When the teeth are in position they are retained by substituting a piece of the non-elastic wire G, Set No. 1, for the spring wire, or, better still, by uniting the bands with solder and re-cementing them, as first suggested by Professor Guilford, and shown in Figs. 11 and 89.

Of the levers shown at L, Set No. 1, four different sizes are furnished. The smallest size is quite strong enough, in most instances, for double rotation, and is most commonly used by me, especially on the teeth of children.

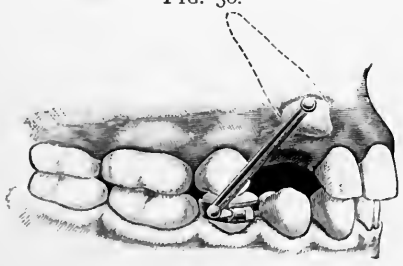
These levers are plated in such a manner as to nearly overcome the annoyance of oxidation and discoloration of the teeth in their use, thus obviating an objection to the employment of steel wire in the construction of regulating appliances.

The reader should never confuse the wire G, Set No. 1, with these levers. Their uses are as different as the material of which they are composed. The levers are used only in rotation (occasionally in expansion), and are never united by solder in forming an attachment; while the wire G, Set No. 1, is extremely tough and malleable and has a very wide range of application, such as reinforcing anchorage, retention, making spurs, staples, etc.

Section VII. Elevation.

The elevation of a tooth in its socket may be accomplished as shown in Fig. 36, wherein a superior cuspid is being drawn out or erupted into line. The clamp-band No. 3, Fig. 6, was fixed

Fig. 36.

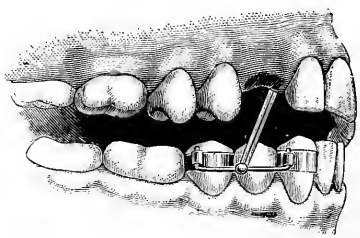


on the lower second bicuspid. A very small hole was drilled into the cuspid, and a short pin was set with thin cement. A common pin answers the purpose very well, and the hole need not be deeper than the enamel if the pin is accurately fitted to it. A rubber ligature was given the patient with instructions

to slip it over the pins, as shown in the engraving. The anchor-tooth in this case is directly opposed by the superior bicuspid. The anchorage is simple and efficient. The ligature may be worn at night only, so as to interfere as little as possible with speech and mastication, although some patients wear it almost continuously. Too strong a ligature should not be worn, as it might endanger the life of the pulp, but gentle traction should be used, gradually directing the tooth into its proper position. The direction of force to be exerted upon the tooth to be moved will of course indicate which tooth in the inferior arch should be selected for anchorage. Should the anchorage fall upon a tooth with no antagonist there would, of course, be danger of loosening it.

Fig. 37 shows a case in which the anchorage was modified to suit the conditions. A deciduous cuspid had been retained too

Fig. 37.



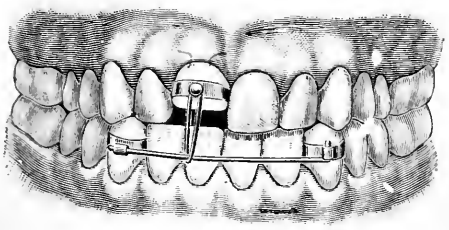
long, causing the permanent cuspid to remain in the alveolar process on the lingual side of the lateral incisor, necessitating a complex movement of the tooth backward, outward, and downward, requiring a very firm anchorage and a strong ligature. On the inferior cuspid and second bicuspid were fixed bands, having pipes R, Set No. 1, atached to their labial surfaces. A piece of the wire G of suitable length was bent at right angles and hooked into the pipes, as shown. The wire fits the bore of the pipe so accurately that in cutting off the ends which emerge through them, each end spreads sufficiently to prevent its coming out. A pin was soldered to the wire about midway between the pipes. The ligature was stretched from pin to pin, as seen in the engraving.

Fig. 38 shows a modification of this method of anchorage. The anchor-wire was made detachable and the pin dispensed with, the patient slipping the wire through the ligature and into the pipes upon retiring, and removing it during the day. A delicate

band (made of F, Set No. 1), to which was soldered the pin, was fixed on the moving tooth.

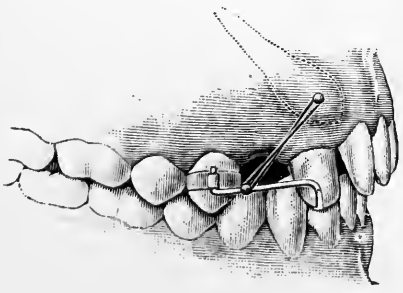
Fig. 39 illustrates a case in which the appliances used were similar to those before described, but the wire anchorage was attached to teeth in the same arch in which was located the malposed tooth. The first bicuspid was banded and a pipe R, Set No. 1, soldered to the labial surface of the band, in which was

FIG. 38.



hooked a piece of the wire G, Set No. 1, the other end of the wire being bent so as to rest on the cutting-edge of the lateral incisor. A pin was soldered to this wire, as in the case before described, and a rubber ligature stretched from pin to pin. In some cases where more force was necessary, I have used the combined anchorage described.

FIG. 39.

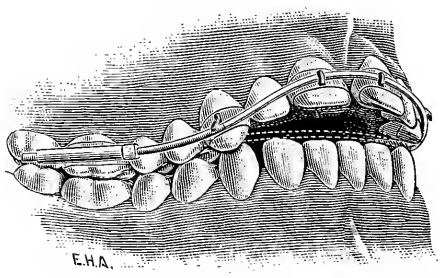


A tooth may also be elevated in its socket by employing either of the wire arches E or B as an anchorage; attaching the ligature to the tooth to be moved in any of the ways already described.

Fig. 40 shows the application of a modification of this principle in a case where all of the superior incisors are being elevated by means of the spring of the wire arch. The arch is made to bear against spurs soldered to bands upon the cuspids, which act as a fulcrum, while the central portion of the arch is sprung upward

and hooked over spurs soldered to bands upon the centrals. The arch should be occasionally removed and modified by bending, in order to maintain the proper amount of spring. Either of the arches (E or B) may be used for this purpose.

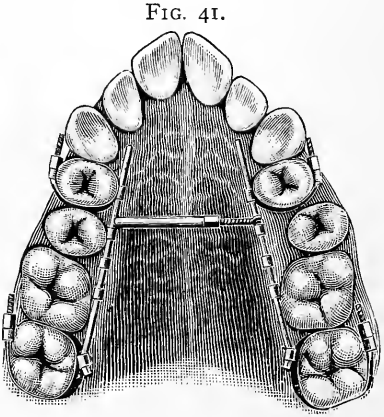
Fig. 40.



Section VIII. Expansion.

There are several methods of expanding the arch by this system. First: By banding and tubing the first and last teeth of those to be moved on each side, and connecting them by means of wire (G) passing through the tubes. The jack-screw is then placed in position across the arch, from wire to wire. Collars R, Set No. 1, are soft-soldered to the wire at intervals to keep the screw

Fig. 41.

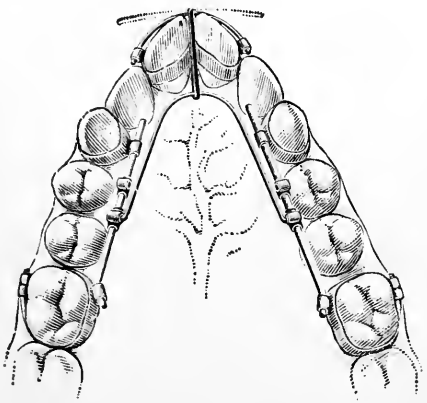


in proper position. The jack-screw may be moved forward or backward, according to the varying requirements of the case. Before placing in position, the wires which pass along the sides of the arch should be bent to correspond to the shape of the sides of an ideal arch, or exactly as we wish the teeth to be when finally arranged. The appliances in position are accurately shown in Fig. 41.

Fig. 42 shows a modification of this method of expansion, the force being derived from one of the levers L, Set No. 1, bent in the form of the well-known Coffin spring, affording all the advantages of the Coffin method of expansion, without the disagreeable features of the vulcanite plate. Its chief advantage over the above method is that it may be also used in expanding the lower arch, without interfering with the movement of the tongue, as would jack-screws.

The appliance for double rotation shown upon the central incisors has already been described, and is repeated only to illustrate how it may be used with advantage while the arch is being expanded laterally; the rubber ligature is used at the same time to retract the incisors.

FIG. 42.

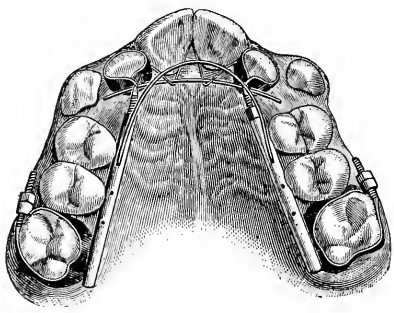


The extra tubes, soldered at right angles to little collars slipped upon the bars on each side of the arch, are for engaging the expanding spring, should it be found necessary to transfer the pressure to that part of the arch. Should it be found necessary to move a tooth beyond this side bar, stretch a rubber wedge between the tooth and bar, as shown in Fig. 86. This simple method of moving a tooth beyond the limits of the appliance will be found valuable in connection with the other parts of the system.

Another method of expanding the arch laterally, as well as anteriorly, is by means of the appliances shown in Fig. 43, wherein the notched ends of the jack-screw engage a piece of one of the wire levers L, Set No. 1, held in position by notches formed in the united ends of the bands upon the lateral incisors. The sheaths of the screws were held by solder to anchor clamp-bands on the first molars. The incisors were moved forward

by turning the nuts upon the jack-screws, while the arch was being expanded laterally, by means of one of the spring levers L, Set No. 1, the ends of which had been bent sharply at right angles, and made to engage the delicate holes bored into the sides of the sheaths of the jack-screws, all as clearly shown in the engraving. A modification of this plan is to exert pressure

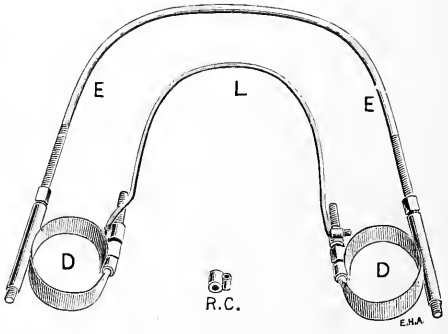
FIG. 43.



laterally by means of a third jack-screw instead of the spring, this screw being notched at each end and made to rest in contact with the screws upon the sides of the arch, anterior to their nuts.

Another excellent method of expanding the arch is by means of lacing the teeth to the expansion-arch E, shown in Figs. 4 and 68. The wire ligatures are occasionally tightened by twisting,

FIG. 44.

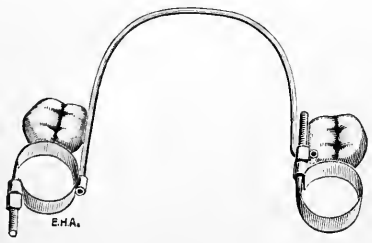


until the teeth have been moved outward and made to conform to the shape of the wire arch. The increasing size of the arch is provided for by adjusting the nuts in front of the tubes upon the anchor-bands. By this method, one or both of the lateral sides of the arch may be expanded, or the anterior part of the arch alone may be moved forward, in which case the teeth are

laced to the arch and moved forward collectively by turning the nuts. (See Fig. 68.)

In expanding the lateral halves of the arch by this method, the wire arch should be straightened sufficiently to give all possible spring, which in most instances exerts sufficient force. In cases where the teeth are extremely firm, the expansion-arch may be reinforced by the spring from one of the levers L, Set No. 1, bent to conform to the inside of the arch, and made to press upon the anchor-bands D. The ends of the wire are held in position by being bent at right angles, and slipped into pipes R, Set No. 1, which have been soldered at right angles to tubes C, slipped over the ends of the screw upon the clamp-bands D, all as shown in Fig. 44.

Fig. 45.

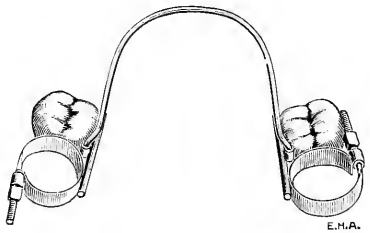


If it is desirable to exert pressure only upon the bicuspids, the spring of L alone is sufficient, when held in proper position, by securing the ends in either of the following ways: By resting in one of the pipes R, Set No. 1, soldered to the clamp-band (the end of the pipe being closed as shown on the left of Fig. 45), the arch being bent so as to lie in contact with and also exert pressure upon the first bicuspid; or the end may be secured, as on the right of Fig. 45, by being bent to engage one of the pipes R, Set No. 1, soldered to the nut upon the clamp-band, the end of the band-screw resting against the first bicuspid. The nut must be removed from the screw while soldering, or pieces of the anchor-wire G, Set No. 1, may be soldered to the clamp-bands encircling the second bicuspids, the front ends in contact with the lingual surfaces of the first bicuspids. To these wires are soldered at right angles the pipes R, which engage the ends of the spring, as in Fig. 46. Or the same attachments to the clamp-bands upon the bicuspids may be made as already described and shown in Fig. 44.

If it is desirable to exert pressure upon one tooth only, a pipe should be soldered to the band over the tooth to be moved; in this pipe rests the end of the spring. Bend the spring so that

all the force will be exerted upon the one tooth to be moved, while two or even more teeth as anchorage on the opposite side of the arch antagonize this force. This latter plan will be found

FIG. 46.



useful in moving outward or inward a single molar, which is sometimes desirable in order to establish perfect occlusion.

CHAPTER VII.

PRACTICAL CASES.

SECTION I. Having completed the description of the principal ways of constructing and adjusting the appliances for moving and retaining the teeth, some practical cases are appended to familiarize the reader with this system, and enable him to more easily comprehend its intelligent employment. Such simple cases as are found in early childhood will be first cited. There is probably no limit as to the time at which the treatment of dental irregularities may be commenced. Cases treated so late as at sixty years of age have been reported; but I am more and more impressed with the great advantages of beginning the treatment early, just as soon as the appearance of irregularities is manifest and the teeth have emerged from the gum sufficiently to admit of banding. Then, when nature is putting forth her best effort, when growth and repair are most rapid, and the surrounding tissues most yielding, employ simple, delicate appliances to gradually move the teeth into their normal positions. Studiously avoid needless interference in those cases where it is apparent that nature will, unaided, correct the deformity; but take professional pride in encounters with the interlocked, twisted and overlapped, or otherwise malposed teeth, which usually become worse and complicate the condition of the teeth yet to be erupted.

There is an impression among a large number of dentists that

treatment should be deferred until after the age of fifteen, or thereabouts, or until the teeth have taken their positions in the arch; but this impression is erroneous and fruitful of much harm, for by that time cases become complex and often exceedingly difficult to treat, and conditions are established which it is impossible to wholly overcome.

With proper appliances used at the right time, a few days will often accomplish what might otherwise require many months if left until the whole dental apparatus is in disorder. The discomfort and annoyance of a suitable regulating appliance is slight in youth, but liable to increase somewhat with advancing years; yet at no time of life, if the operation be skillfully performed, need there be more than inconvenience; never real pain.

FIG. 47.

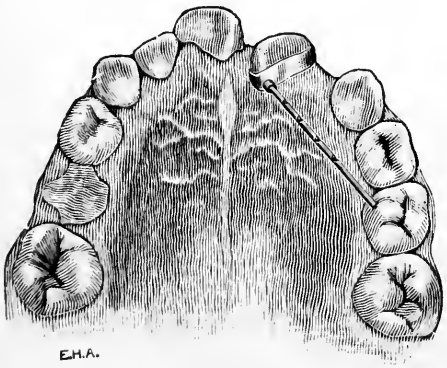


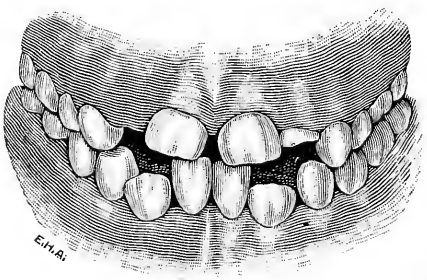
Fig. 47 shows an erupting central incisor being moved out of inlock. The tooth was banded and one of the pipes R, Set No. 1, soldered to the mesio-lingual angle of the band; one end of a piece of the wire G, of suitable length, was inserted into this pipe, and the other end secured in a pit formed in the enamel of the second deciduous molar. Force was exerted upon the tooth to be moved by occasionally pinching this wire with the regulating pliers H, Fig. 8 B, two or three pinches being enough to lengthen the wire sufficiently to move the tooth as far as it should be at one sitting. The force of the wire being exerted wholly upon the mesio-angle of the tooth, it was rotated as well as moved out of inlock. The occlusion of the lower incisors retained it in its new position.

Of course, one of the jack-screws, instead of the wire, might have been employed, but the force exerted by stretching the wire is so simple, and the mere wire so compact and powerful, that it

is now employed, especially in the treatment of children's teeth, whenever possible.

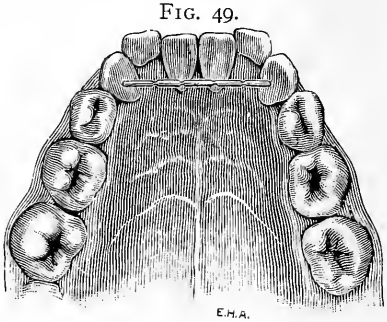
Fig. 48 illustrates a case which I believe to be so common that it may be regarded as typical, and the method of treatment is one which may be generally employed in this class of cases. Because of lateral pressure the superior central incisors had erupted much anterior to their natural positions, and the laterals were appearing

Fig. 48.



posterior to their correct positions (this condition is not clearly shown in the engraving); while the lateral pressure from the inferior deciduous cuspids caused the central incisors to erupt inside, and the laterals outside of the line. The treatment clearly indicated was to exert lateral pressure upon the inferior cuspids, sufficiently to provide space for the erupting incisors. As the lower cuspids were gradually forced farther apart their occlusion

Fig. 49.



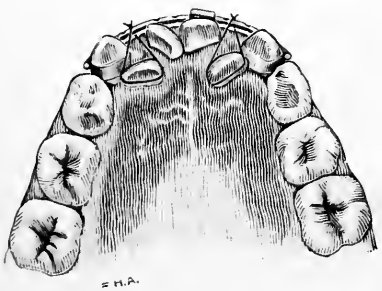
with the superior cuspids caused them also to be forced farther apart, thereby providing space for the erupting superior incisors. No attempt was made to straighten the incoming teeth other than to provide space for their proper eruption.

The appliance exerting lateral pressure upon the inferior cuspids is shown in Fig. 49. A straight piece of the wire G, Set No. 1, was secured by springing the ends into pits formed in the enamel

on the lingual surfaces. Force was exerted by occasionally pinching with the regulating pliers to lengthen the wire as already described. About once a week was as often as the wire was lengthened.

Fig. 50 shows another case in which a modification of this plan of treatment was used. Not only was it requisite to exert lateral pressure upon the inferior cuspids in order to provide space for the erupting permanent incisors, but also to apply gentle pressure to the laterals which were erupting far inside of the dental arch. The cuspids were banded and pipes R, Set No. 1, attached to their disto-labial surfaces. The distal ends of the pipes were then closed by a soldered piece of band material. Into the other ends of these pipes was slipped a piece of the wire G, bent to conform to the curve of the arch. Force was exerted by pinching the wire with the regulating pliers H, Fig. 8 B, as before described. Gentle

FIG. 50.



traction upon the malposed laterals was made by encircling them and the regulating-wire with ligatures, which were occasionally tightened by twisting. The occlusion of the cuspids with the superior cuspids, as in the case last described, caused the expansion of the upper arch. I believe the line of treatment here indicated, namely: beginning at the proper period, gently expanding the inferior arch and perfectly arranging the four incisors, will solve the problem of treatment in a very large percentage of cases, the upper teeth being forced to develop normally by the occlusion with the moving lower teeth.

In pursuing this line of treatment, the expansion of the lower arch must be accomplished very gradually, or an inlocking of the upper teeth will be the result.

Fig. 51 shows the expansion of the anterior part of the inferior arch by the same method, the ends of the wire being soldered directly to the lingual surfaces of the bands encircling the cuspids. The patient was a young lady, twenty-two years of age, and con-

siderable force was necessary, but the force exerted by pinching the wire was found sufficient.

The centrals were drawn into the line of arch by means of wire ligatures, occasionally tightened.

A little experience in stretching the wire with the regulating forceps will enable the operator to manipulate the wire, by bending as well as pinching, so that rotation as well as other movements may be thus accomplished.

FIG. 51.

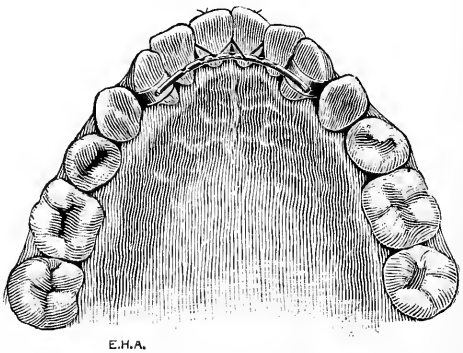
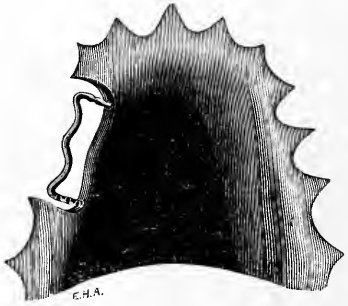


Fig. 52 shows how an ordinary stay-plate may by this method be modified to advantage by removing a portion of it and substituting in its place a piece of the wire G, Set No. 1, bent and inserted in such a way as to bring pressure upon the teeth to be

FIG. 52.

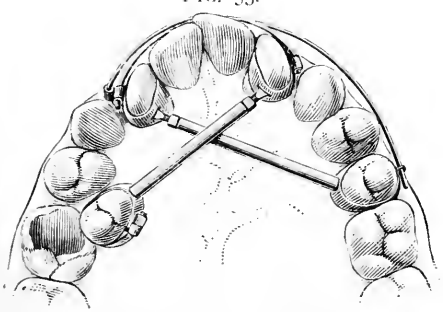


moved; which pressure is occasionally intensified by pinching the wire with the stretcher.

Fig. 53 represents the result of an unnatural contraction of the lips, thus bringing undue pressure on the anterior part of the arch during the eruptive period, and forcing the teeth inward. They were pushed outward by the jack-screws resting over spurs upon the anchor-bands, the chisel ends of the screw resting in slots

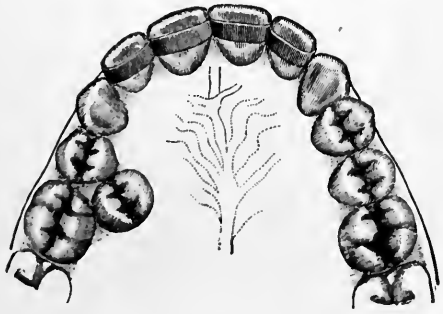
formed in bands on the moving teeth. (See B, Fig. 20, and C, Fig. 21.) The teeth were also rotated at the same time with the rotating levers previously described, and here well shown. In this instance two levers were used, crossing each other in the center. The lever on the left was anchored by latching it into a hook soldered to the anchor-band on the second bicuspid. The

Fig. 53.



other lever was anchored by hooking it into one of the little pipes R, Set No. 1, soldered at right angles to the tube on the band of the lateral which engages the other lever. A better way would have been to have secured this end of the lever by a ligature around the end of the other lever, but it is here shown to illustrate one of the many optional ways of securing the end of the lever.

Fig. 54.



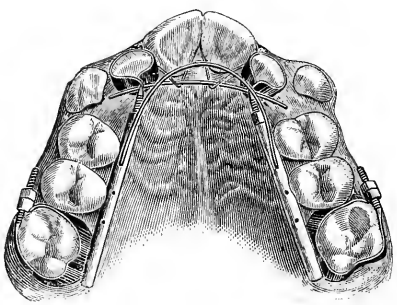
It will be seen that the central incisors also need rotating. This could have been easily accomplished by the double rotation lever, but the same practical result was attained by lacing them to the levers with wire ligatures. They were retained by bands united with solder. (See Fig. 54.) This is an excellent method of retention, and was first suggested by Dr. Guilford. They

could have been retained by my own method, namely, by passing a piece of retaining-wire G through the horizontal pipes which had secured the ends of the levers, and lacing the centrals to it; but, although a simple and effective device, it would have been a little less sightly.

Fig. 55 shows a form of irregularity frequently met with. The arch is narrow, and the lateral incisors are being rapidly forced inward by the erupting cuspids. In a very few months, without treatment, the lateral incisors would be forced far inward, and even the apices of the roots would be malposed; therefore, the earlier regulation is begun the better.

The proper treatment is the expansion of the arch in the region of the bicuspids, and the moving of the centrals forward and the

FIG. 55.



laterals outward. In the case illustrated this was accomplished by the jack-screws engaging at their notched ends a piece of one of the levers L, Set No. 1, made to rest in notches formed in the united ends of the bands encircling the lateral incisors. Anchorage for the jack-screws was gained by soldering the sides of the sheaths to the anchor-clamp for the first molars (as in F, Fig. 20), while the lateral sides of the arch were forced outward by means of a piece of one of the spring levers L, Set No. 1, the ends of which were bent sharply at right angles and made to engage small holes drilled through the sheaths of the jack-screws. Wire ligatures were made to encircle the central incisors and the spring lever engaged by the notched points of the jack-screws. All as clearly shown in the engraving. The extra holes represented in the sheaths were for shifting the expansion spring, should it be found necessary.

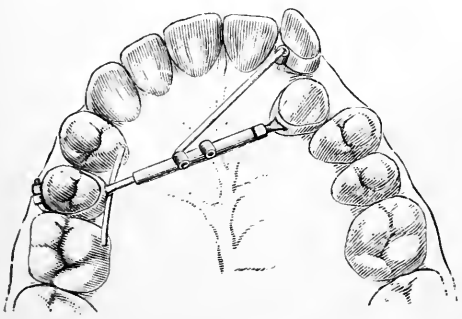
After the teeth had been moved into their desired positions, the bicuspids were held outward by a delicate-fitting stay-plate, similar to Fig. 52, while the incisors were retained by means of a piece

of the wire G, Set No. 1, connecting the bands upon the lateral incisors, the ends being soldered to the labial surfaces of the bands and the intervening portion of wire lying in contact with the labial surfaces of the central incisors. These retainers were worn until the cuspids were fully erupted and all the teeth had become firm in their new positions.

I should add, this patient originally suffered from greatly enlarged tonsils.

Fig. 56 shows a case such as is frequently encountered in some of its modifications. The inlocked cuspid has forced the lateral outward. It will be seen by studying the appliance that it served the double purpose of pushing outward the cuspid, while pulling inward the lateral; the sheath of the jack-screw being cut short, allowing it to travel downward over the spur as the nut is turned,

FIG. 56.



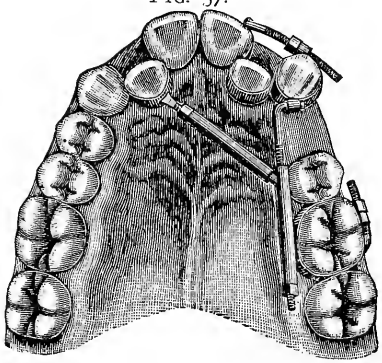
until its base finally rests against the band, when the lateral will have been drawn into place, and will reinforce the anchor-tooth in resisting the moving cuspid. This is another instance of reciprocal anchorage, or that of pitting one irregular tooth against another. It is a principle of great value, and should be carefully studied and made use of whenever possible. The extra pipe on the sheath of the jack-screw was for further reinforcing the anchorage, if necessary, by hooking another piece of the wire G into the pipe, and fixing the other end on a band upon the first bicuspid. Reciprocal anchorage may be gained by substituting for the wire attached to the lateral the small traction-screw C and B, Fig. 1, Set No. 1. They were retained by uniting their bands with solder and recementing them on the teeth.

Fig. 57 shows a typical case and the combined appliances actually used. The laterals were inlocked, the left cuspid pushed forward. While the large traction-screw was drawing back the

cuspid, as already described on page 28, it was assisted by the loop and small traction-screw (see Fig. 26), acting at the same time in forcing outward the left lateral; another instance of reciprocal anchorage.

The other lateral was, at the same time, forced outward by the

Fig. 57.



jack-screw, the base of which was slipped over a spur soldered to the sheath of the large traction-screw, again making use of reciprocal anchorage by assisting the traction-screw in resistance to the cuspid. The anchorage of the jack-screw might be reinforced, as already described in Fig. 24. Other modifications of this combination will readily suggest themselves.

Fig. 58.

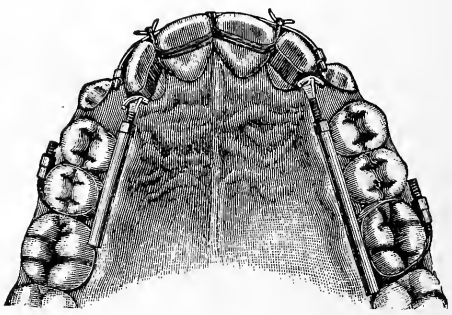
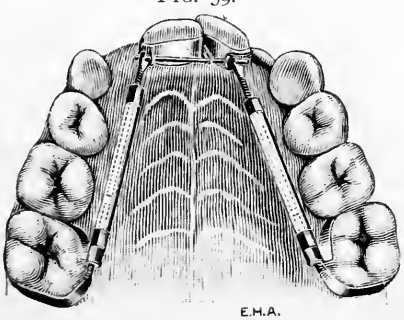


Fig. 58 represents a common form of irregularity. All of the incisors are pressed inward, not enough to cause inlocking of the same, but sufficient to necessitate the closure of the lower jaw posterior to the normal occlusion, in some instances causing jumping of the bite. As a result, there is not sufficient room for the cuspids, and in the effort to take their natural positions (a

tendency always strong with them), the laterals are forced still farther inward, as well as partially rotated. The aim will be to force forward all the incisors, making correct occlusion, as well as providing space for the cuspids. The rotating levers are applied to the laterals, and the centrals firmly laced to the same, while all are being forced forward by the jack-screws soldered to the anchor-bands (see F, Fig. 20), the chisel-ends resting in staples (as in E, Fig. 21), soldered to the bands on the laterals to also permit their rotation. The cuspids were brought downward by the methods shown in Fig. 36 or Fig. 39.

Fig. 59 represents the case of a little girl, eight and one-half years of age. The centrals were inlocked, the left one being also greatly twisted. As soon as they had sufficiently emerged from the gums they were banded. The union of the ends of the bands

FIG. 59.

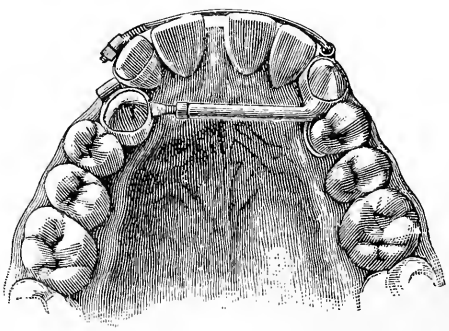


was made at the disto-lingual angle. Small holes were made in these united ends, through which was slipped a piece of one of the small levers L, Set No. 1. The notched ends of the jack-screws engaged this wire lever. The base of the sheaths was secured by being slipped over the ends of the clamp-band screws. (See J, Fig. 20.) Rotation of the central was accomplished at the same time the teeth were being moved out, by occasionally tightening a wire ligature surrounding the spring wire and a spur soldered to the labial surface of the band. After the teeth had been moved in the desired position, they were retained by the appliances for a few days, until all tenderness had subsided, when the bands upon the centrals were united by solder, re-cemented, and the rest of the apparatus dispensed with. The occlusion of the lower teeth is usually sufficient to retain such teeth as have been moved out of inlock, after they have been steadied in their new position for a few days by an appliance. But in this case

the retaining bands were worn until the lateral incisors had fully erupted, in order to prevent the possibility of their again overlapping.

Fig. 60 shows a malposed lateral and central. The base of the jack-screw was soldered to a band on the opposite cuspid, and reinforced by a spur resting against the first bicuspid, as also by the large traction-screw, which is hooked into a tube, D, Set No. 1, soldered to the labial surface of the band. The screw passes in front of the incisors through a tube (against which the nut works) soldered to a band on the labial surface of the lateral incisor. In this case the left central and lateral were wedged forward in the

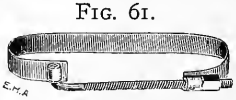
Fig. 60.



line of arch, closing the space between the centrals and, at the same time, providing space for the outmoving cuspid. The large screw was beaten flat and polished before insertion.

I have sometimes closed similar spaces between the incisors by the appliance shown in Fig. 61, which consists of tubes, C, Set No. 1, soldered to the ends of a piece of the band material long enough to nearly inclose the four incisors. The small traction-screw B is inserted in the tubes, and the space contracted by turning the nut.

Fig. 61.



Figs. 62, 63, and 64 show other simple and convenient ways of moving a tooth into line. In Fig. 62 the anchorage for the ligature is a sheath of the jack-screw J, Fig. 20, slipped over the end of the screw upon the molar clamp-band. Force is exerted by occasionally tightening the wire ligature around the sheath and

tooth to be moved. In some instances the sheath may be dispensed with, as in Fig. 63. Another modification is shown in Fig. 64, which consists of a pipe (R, Set No. 1) soldered perpendicularly to the side of the clamp-band, into which is hooked a piece of the wire G, Set No. 1, which rests against some suitable

Fig. 62.

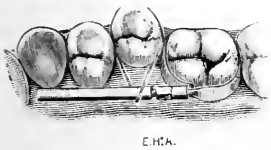


Fig. 63.

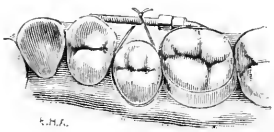
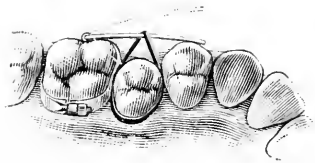


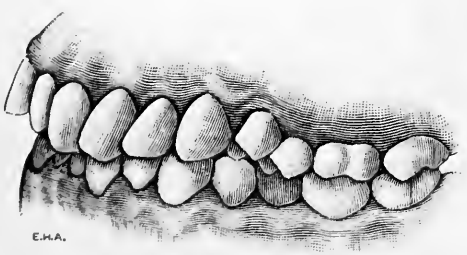
Fig. 64.



tooth, to assist the anchor-tooth; the anchor-wire and the tooth to be moved being encircled by a wire or rubber ligature.

Fig. 65 is a side view of a very marked case of irregularities of the teeth of both arches, the patient being a young lady of sixteen years. The superior arch was much compressed in front, the incisors greatly twisted and overlapping, and the cuspids very

Fig. 65.



prominent, as shown in Fig. 66. The first molars and bicuspids were also more or less malposed, while the inferior arch was much contracted, and all the teeth anterior to the first molars were very irregular. The treatment consisted in establishing correct occlusion by forcing the malposed teeth into their correct positions in the arches. This was accomplished in the lower jaw by means of the expansion-arch E, anchor-tube and clamp-band D, wire liga-

tures and bands, as shown in Fig. 67; also shown in position in Fig. 68. The bicuspids were moved outward by wire ligatures occasionally tightened by twisting, while at the same time and

FIG. 66.

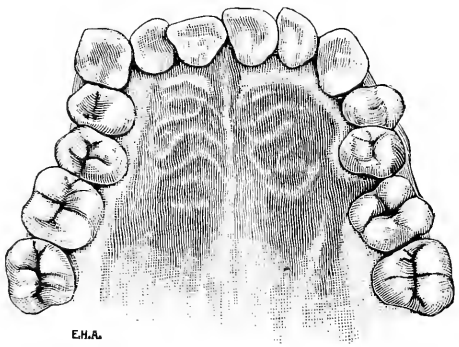


FIG. 67.

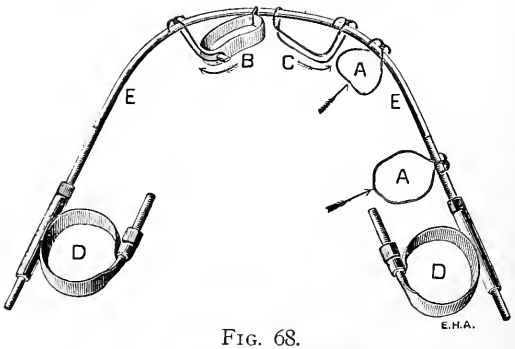
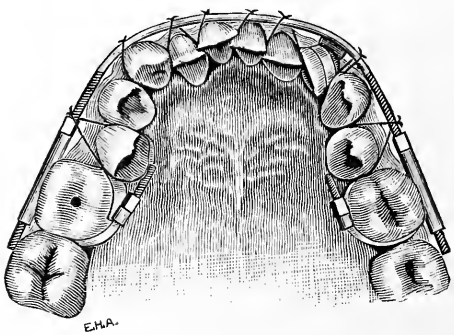


FIG. 68.



by the same means the incisors were being drawn into proper positions, and made to conform to the shape of the wire arch passing in front of them. They were also moved forward at the same time by the tightening of the nuts in front of the anchor-

tubes upon the molars, thus providing more space for the bicuspids as they were forced outward. The cuspid was rotated with a wire ligature, attached to a spur upon the disto-lingual angle of the band, while force was being exerted in an opposite direction upon the mesio-labial angle of the tooth, by a rubber wedge stretched between the tooth and the wire arch, all as correctly shown in the engraving.

Fig. 69 shows the case nearing completion. After the move-

FIG. 69.

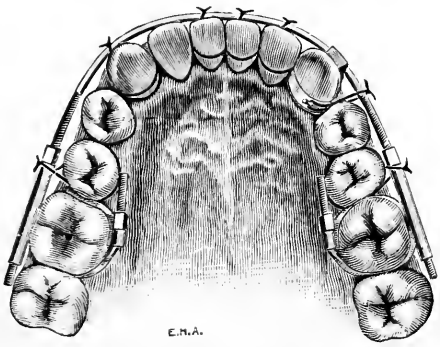
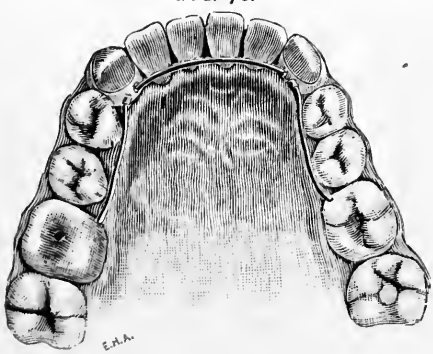


FIG. 70.

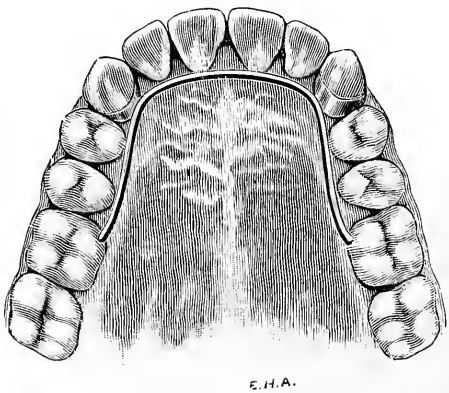


ment of the teeth had been completed they were retained for about two weeks, until all tenderness had subsided, by the appliance already in position and shown in Fig. 69. The appliance was then removed and the teeth permanently retained as seen in Fig. 70. The cuspids were carefully banded, and the ends of a piece of the wire G, Set No. 1, were soldered to the lingual surfaces of the bands, the wire resting in contact with the lingual surfaces of the incisors, and preventing their again moving inward, as also resisting lateral pressure from the cuspids. The bicuspids were

prevented from moving inward by pieces of the wire G, resting on the lingual surfaces and held in position by their anterior ends inserted into pipes (R) soldered to the disto-lingual surfaces of the bands. The distal ends of the wires were made to rest in small cavities formed in the mesial surfaces of the first molars, one of which had long been covered by a gold crown.

The teeth in the upper arch were forced into their correct positions by an appliance similar to that shown in the treatment of the lower arch already described. The incisors were moved forward and rotated by means of the ligatures and tightening of the nuts in front of the anchor-tubes, while pressure was exerted upon the prominent cuspids and bicuspids by the spring of the wire arch intensified by intervening wedges of rubber. The first

FIG. 71.



molars were rotated at the same time by the tubes upon the anchor-bands being so adjusted that rotating force was exerted by the spring of the wire arch. After the teeth had been moved they were retained in the way described for the retention of the teeth in the lower arch, with the exception that one continuous piece of the wire was used, accurately shown in Fig. 71.

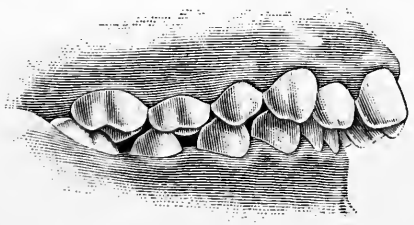
This method of retention is useful in all cases of this class. Considerable accuracy is necessary in the adjustment of the band, wire, etc.; however, if, after adjustment, it is found shorter than it should be, it is easily lengthened by a few pinches with the wire-stretchers H, Fig. 8 B; if found slightly longer than necessary, it is easily shortened by bending it to conform to the circles of the teeth by means of a burnisher pressed against the wire in the region of the interdental spaces. If, after a time, it is found that one of the intervening teeth shall have moved slightly inward, it

should be again moved outward by a wedge of rubber stretched between retaining-wire and tooth for a few days. The wedge is then removed, and the soft wire burnished or driven outward in contact with the readjusted teeth. The distal ends of the retaining-wire should always be set in cement, and the pits should be carefully filled after the removal of the retainer. The retainers in the case here shown were worn for one year. They were so compact and cleanly that the patient was in nowise inconvenienced, and the improvement in her appearance after the treatment can be better imagined than described.

Section II. Jumping the Bite.

Fig. 72 truthfully represents the side view of a case of increasing prominence of the anterior upper teeth, the cause of which I believe was clearly traceable to the premature loss of the inferior first molars. The occlusion of the second inferior molars with the

Fig. 72.



superior first permanent molars is well shown in the cut; and as this occlusion naturally continued with the inevitable tipping forward of the inferior second molar into the space vacated by the first molar, the lower jaw was gradually drawn backward until the jumping of the bite of the developing cuspids and bicuspids had taken place. At the same time the compression of the lateral halves of the superior arch, in order to better conform to the decreasing size (by recession) of the lower arch naturally followed, producing, as is here well shown, the condition which is similar to thousands of cases resulting from the extraction of the inferior first molars by ignorant or unscrupulous practitioners.

The treatment consisted in widening the upper arch sufficiently to permit of the lower jaw being moved forward, and there retained until the habit of normal occlusion had been re-established. The arch was expanded by means of the wire arch B (expansion-arch E would have answered), and anchor clamp-bands D, as shown in

Set No. 2. The centrals and laterals were moved outward, and rotated by occasionally tightening wire ligatures encircling the arch and spurs soldered to bands upon the moving teeth. All as clearly shown in Fig. 73.

Fig. 74 correctly represents the case as seen after the expansion of the arch was completed, the deciduous second molars having in the mean time been lost, but not yet replaced by the bicuspids.

FIG. 73.

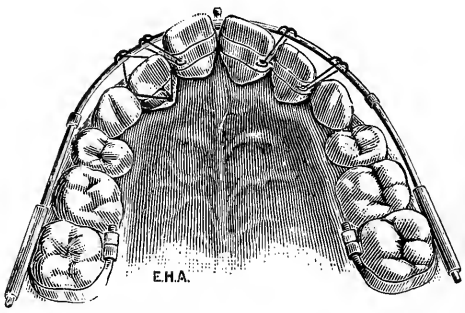
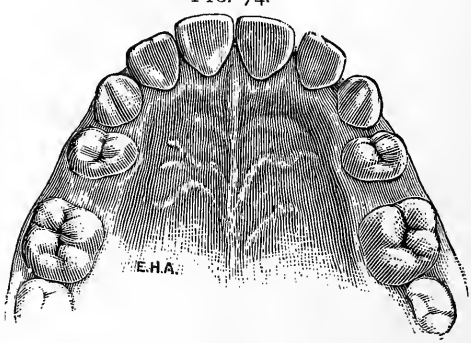


Fig. 75 shows the lower jaw moved forward to its correct position, where it was retained by means of a spur imbedded in the inferior permanent molar, thus compelling the normal closure of the jaw. The retention of the upper anterior teeth was accom-

FIG. 74.



plished wholly by the proper occlusion with the lower. The spur has now been worn six months, and, I believe, might be discontinued without fear of recession of the jaw; but, as it occasions no inconvenience, it will be worn for a few months longer, or until the eruption of the second superior bicuspid shall necessitate its being gradually shortened by grinding.

It seems to me that jumping the bite is not difficult of accom-

plishment, and is a most natural and advisable plan of treatment where the age of the patient and other conditions are proper.

Fig. 76 shows another case of very marked irregularity, where both centrals and laterals and right cuspids were greatly turned; they were also pushed forward, as shown in Fig. 77.

FIG. 75.

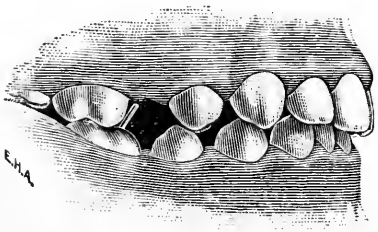
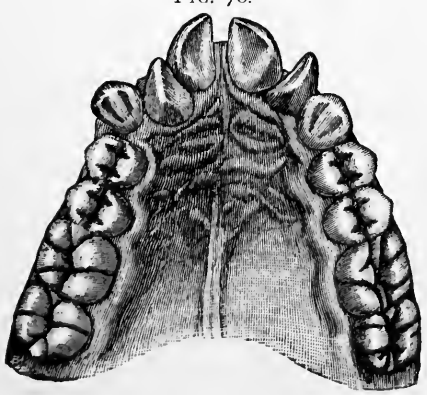


Fig. 78 shows the appliances as adjusted at the commencement of the treatment. It will be seen that the cuspids are being moved backward into the spaces from which the first bicuspids have been extracted, by means of the large traction-screws (A and D, Set No. 1), adjusted and operated as described on page 28. It will

FIG. 76.



also be noticed that the angle of the traction-screw on the right is hooked over a spur, or, better, a staple made from wire G, Set No. 1, soldered at right angles to the band, thus concentrating all the force on one side of the tooth as it moved backward.

The central incisors are being rotated by means of the lever, as described in Fig. 34. Their prominence was also reduced at the same time by means of the occipital bandage and traction-bar, as described on page 40.

Fig. 79 exhibits the case after being acted upon by the appliances already described. They were retained by uniting with solder the bands and re-cementing them upon the centrals, while

FIG. 77.

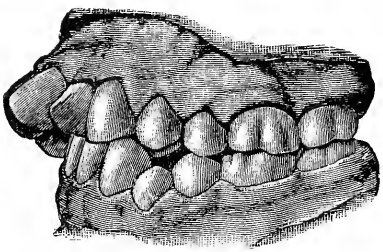


FIG. 78.

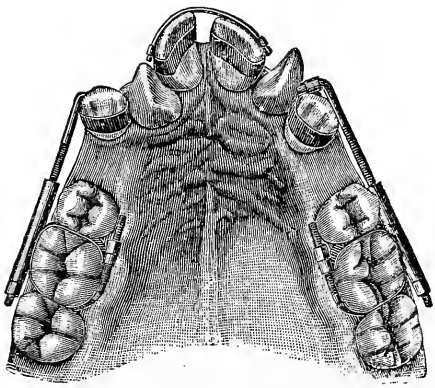
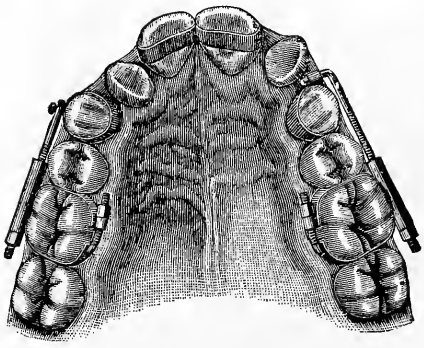


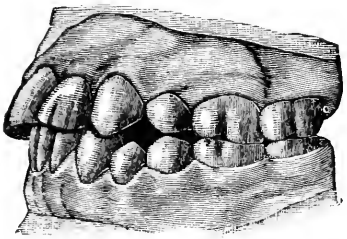
FIG. 79.



the traction-screws retained the cuspids. The rotation of the lateral incisors was accomplished with the rotating levers in the usual way, securing the ends of the levers by ligatures attached to the distal ends of the traction-screws. After they were rotated,

the bands were removed, united with solder to the bands upon the centrals, and all reset on the teeth with cement. The traction-screws and bands upon the cuspids were removed, and the case then presented the appearance shown in Fig. 80. The retaining-bands were worn one year, after which the teeth showed no tendency to return to their former positions.

FIG. 80.



SECTION III. EXCESSIVE PROTRUSION OF THE UPPER TEETH.

Fig. 81 represents a typical case of a very marked class of dental irregularities, quite common and always unsightly. The principal characteristic is the excessive prominence of the superior incisors, laterals, and cuspids. The upper lip is always short, probably due to lack of development from being held in an abnormal position, and through inability to close the lips over the prominent teeth.

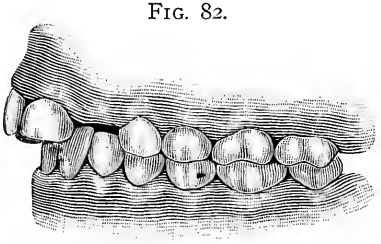
FIG. 81.

The lower jaw is generally short, and the occlusion of the molars and bicuspids is usually good, although posterior to the normal. As a result the lateral halves of the superior arch are commonly closer than normal, so as to be better accommodated to the smaller circle of the lower arch. The lower incisors are more or less irregular, and their cutting-edges always occupy a higher plane than normal, doubtless owing to the lack of working occlusion. As a result of the frequent attempts at complete closure of the mouth, the lower lip is forced between the upper and lower

incisors, and exerts pressure outward upon the superior and inward upon the lower incisors, which intensifies the malpositions of both. This form of irregularities is usually associated with conditions of the nasal passage which necessitate mouth-breathing.

Fig. 82 represents a side view of a case of a child eight years old, whose nasal passage was obstructed for three or four years, necessitating mouth-breathing. The superior centrals had erupted much anterior to their proper positions, their labial surfaces nearly at right angles, while the laterals had not yet erupted. The deciduous cuspids and molars were in position, as well as the first permanent molars. As the mouth was held open so much of the time, the lower jaw was either gradually forced back from its normal occlusion or prevented from developing, while the upper arch contracted laterally, in order to better accommodate the occlusion to the smaller circle of the retreating lower arch. The

FIG. 82.



development of the upper lip seemed to have been arrested, and had but little restraining influence upon the upper incisors, which were being acted upon unfavorably by the forcing of the lower lip between the upper and lower incisors, in the frequent attempts at swallowing. This pressure of the lip had also exerted an influence upon the lower incisors. They were becoming bunched and forced inward, thereby allowing more space for the lip to occupy between the upper and lower incisors. The conditions then were favorable for the development of excessive protrusion of the upper anterior teeth and all the accompanying deformities already described in the case of the adult.

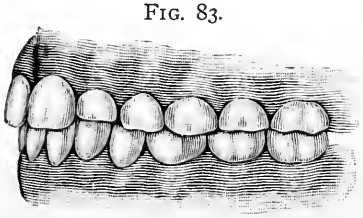
The plan of treatment of these cases should vary according to the age of the patient. In the present instance the child was first referred to the rhinologist for treatment of the nasal passages. He having been successful, efforts were then directed to the restoring of the normal occlusion of the teeth.

The central incisors were rotated after the manner described in double rotation. The lower incisors were made to occupy their

correct positions in the arch, after plan shown in Fig. 51, and were also slightly shortened by grinding. The upper arch was expanded laterally to permit the movement of the lower jaw forward so that the teeth might occlude normally, as shown in Fig. 83. Breathing through the nose was encouraged, and the patient directed to keep the lips closed and teeth in proper occlusion as much of the time as possible, and I had the satisfaction of seeing the habit of normal occlusion, as well as normal breathing, re-established.

In the treatment of cases fully developed, it would be useless to attempt to restore normal occlusion, as in the case last described —viz, widening the upper arch and moving the lower jaw forward. The general plan of treatment, then, is as follows: First, to compress the superior incisors in their sockets. Second, to reduce the

FIG. 83.



E.H.A.

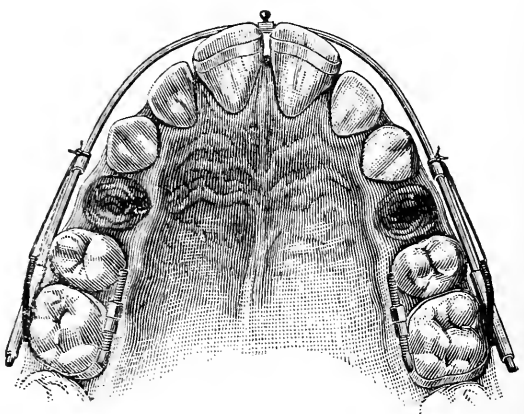
size of the superior arch by extracting one or both of the first bicuspids, and move the incisors and cuspids backward. Third, to correct the malpositions of the inferior incisors and cuspids, and reduce their length by grinding. Fourth, to establish normal breathing and normal closure of the lips. For accomplishing this the Set No. 2 (see Figs. 2 and 3) was especially designed, and comes the nearest to the ideal of all appliances yet devised.

The anchor-bands and tubes D are made to encircle the first molars. The ends of the wire arch B are slipped through the tubes. The anterior part of the arch is held in position by bands on the central incisors, having notches formed in the united ends upon the mesio-labial surfaces, into which the arch rests, as shown in Fig. 84.

Force is exerted upon this wire arch by heavy elastic bands attached to the head-gear, as in Fig. 85. This force is received and transmitted to the wire arch by means of the traction-bar A, Set No. 2, the standard seen upon the center of the traction-bar engaging the delicate ball upon the center of the wire arch. The hooks upon the ends of the traction-bar receive the ends of the elastics. Any degree of force may be exerted upon the prominent

teeth by increasing or diminishing the tension or size of the elastics. The force received from the head-gear acts on the wire arch through the ball-and-socket joint. The ends of the traction-bar may, therefore, be casually moved in any direction. The advantage is that in consequence of the freedom of motion, a jar or shock upon the traction-bar ends will not be transmitted to the tender teeth. As the bandage and bar are to be worn at night, contact with the pillow would be liable to occasion pain were it not for this freedom of movement, an advantage possessed by no other device of its class and appreciable by both patient and operator. The usual method is to rigidly attach the traction-bar, or its equivalent, to a swaged or vulcanite cap covering and firmly resting against all the teeth to be moved.

FIG. 84.

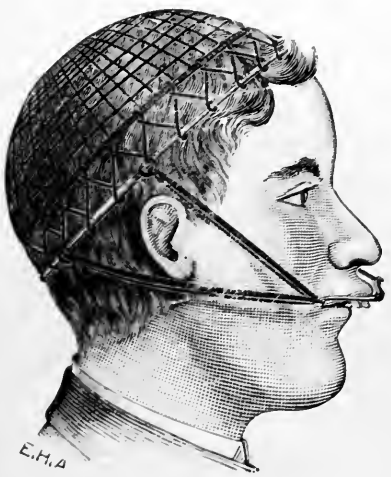


At such times as the head-gear and elastics are not worn, provision is made for holding what has been gained by delicate rubber ligatures E, E, Set No. 2, which are slipped over the distal ends of the tubes on the molars, stretched forward, and tied with silk ligatures in front of the small collars which encircle the wire arch opposite the cuspids, as seen in Fig. 84.

These collars, being rigid, prevent the ligatures from sliding back, and thus exert a gentle but constant traction on the moving teeth, and prevent them from springing back and interfering with the process of repair. Of course, these ligatures are worn constantly. Another advantage of the device is, that not only is the prominence of the teeth reduced, but the malposed teeth are gradually forced to take regular positions and conform to the shape of the ideal arch (as it is forced backward through the tubes on

the molars), an action impossible with devices having fixed caps of vulcanite or gold. Still another advantage is, that if the arch should need lateral expansion, as is frequently the case, it may be accomplished at the same time the teeth are being moved backward, by lacing to the wire arch such teeth as need to be moved outward. But in obstinate cases the jack-screw, notched at each end and resting in contact with pieces of the G wire, may be employed, as clearly shown in Fig. 86, wherein two rubber wedges, shown resting between the bicuspids and wire, were used to move them farther outward than was possible with the straight wire. The head-gear proper has been greatly improved, as a result of

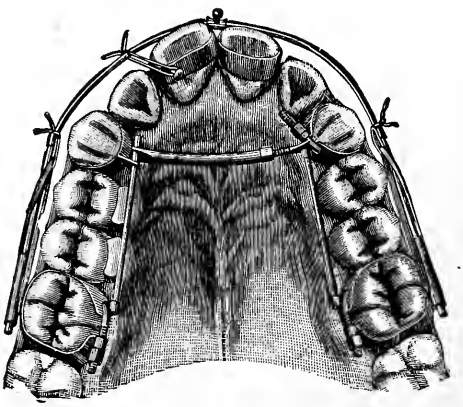
FIG. 85.



much experimenting, and is correctly shown in Fig. 85. It consists of a non-collapsible spring rim, adjustable as to size by the spring latch on the side. The netting covering the head is adjusted by tightening or loosening the silk cord connecting the rim with the heavy silk netting, which provides for thorough ventilation. One great advantage of this head-gear is, that the rim receives the force and distributes it equally over the entire back of the head, so that much greater pressure can be borne without causing headache, a common result of the old styles, through interference with the circulation by local pressure. The engraving shows two elastics on each side, one attached to the cap above and one below the ear. The points of attachments are, however, to be varied according to the requirements of the case. In nearly every instance it will be found that the teeth should not only be

moved backward, but be depressed in their sockets. For, if merely moved backward, the teeth will present such a lengthened appearance that the result will be nearly as bad as the original deformity. Therefore, it would be plain to any careful observer of these cases that the plan so often advocated, of exerting force from the molars only, is wrong, for tipping of the anterior teeth is the only result by anchorage from that point; but with the occipital anchorage there is perfect control over the direction of the force, by simply making the attachments to the anterior elastics farther forward or backward. Or if elongation of the teeth be necessary, the lower ligature only is used, dispensing with the upper or using only a very light one. These ligatures may be doubled after the patient

Fig. 86.

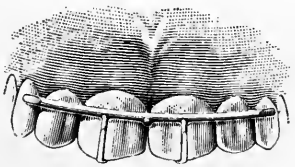


has become well accustomed to wearing them. The teeth are to be retained by the wire arch, Fig. 84 (the head-gear, traction-bar, and delicate ligatures being of course dispensed with), which is kept in position by passing a delicate drill through the tubes on the anchor-teeth, and inserting neatly-fitting pins into the holes thus made, as in Fig. 23. This method of retaining is very effectual, and as long as the appliance is so worn the teeth cannot change their proper positions. But as it is somewhat unsightly, and the patient has already worn it for some time, its removal will be requested; and, it being of great importance in these cases that the teeth be firmly retained for a long period (at least one year), a device less objectionable in appearance should be used. After much experimenting, I find that the appliance shown in Fig. 87 effectually meets the requirements. It is retention by means of the occipital bandage or head-gear, but should never be made use of immediately after the movement of the teeth has been accom-

plished, but only after the teeth have been retained by the other appliances for at least two months, or long enough to allow the teeth to have become thoroughly rested in their new positions and somewhat firmly established. The arch, bands, and tubes upon the molars, as well as on the incisors, should then be removed, and the teeth thoroughly cleansed. After which, careful impressions are taken of both upper and lower jaws, and accurate models made. Careful comparison of the natural teeth with these models is to be made from time to time, in order to detect any unfavorable changes should they occur.

The retaining appliance, Fig. 87, is then adjusted, and is to be worn at night-time only, thus allowing the patient entire freedom from all appliances during the day. It consists of a segment of the wire arch (B) long enough to pass in front of the incisors and cuspids, and carefully bent, so that it will rest in contact with them.

Fig. 87.



Two short pieces of the wire G, Set No. 1, are soldered at right angles to this wire, opposite the front of the central incisors. They are long enough to admit the ends being bent over the cutting-edges of the incisors, and the hooks so formed will hinder the appliance from sliding upward against the gum. The device is prevented from sliding laterally by a short piece of the G wire soldered at a point between the centrals. This spur should rest in the depression between these teeth; the opposite end forms the delicate ball which engages the socket in the standard of the traction-bar, all accurately shown in Fig. 87. It is adjusted by sliding it into position upon the teeth, and, if it has been carefully made, will not be displaced after the head-gear and traction-bar have been adjusted. This device may also be made of vulcanite, having a spur imbedded at the proper point corresponding with the delicate ball which engages the traction-bar.

In the adjustment of Set No. 2 it is usually better to place in position only the anchor-bands and tubes (D) at the first sitting, or at most the additional bands upon the incisors. At the second sitting the arch B may be placed in position and worn a few days until the patient becomes accustomed to wearing it, when the

head-gear may be adjusted, with light tension at first, gradually increasing the same, as well as the number of hours worn, which should finally include as much of the time as possible, in order to expedite the completion of the case.

The wire arch B should be bent occasionally as the case progresses, in order to exert pressure on such laterals or cuspids as need to be restrained while moving back; and, if any of the teeth should show tendency to bunching or overlapping, this should be prevented by lacing them to the arch, after plans of ligatures shown in Fig. 28. If any of the teeth show tendency to lengthening, this should also be prevented by bands and notches which shall engage the arch B. Never use larger ligatures than those shown at E, E, Fig. 2, as the force necessary in moving the teeth is exerted by the *heavy* elastics and head-gear; by increasing the size of the small ligatures disturbance of the anchor-teeth, such as tipping, elongating, and the establishment of faulty occlusion *will follow, something especially to be avoided* in the treatment of these cases, for it should also be remembered that no moving force upon the teeth should be exerted by these merely *retaining* ligatures.

In order to produce room for the protruding teeth, it is sometimes necessary to extract one or two of the bicuspids. Where the loss of one is sufficient the moving teeth may be shifted laterally in order to fill this space, by inserting a folded handkerchief or a small cushion between the face and heavy elastic bands, thus exerting lateral pressure upon the traction-bar standard and wire arch.

The wire coiler shown at N, Fig. 8 A, is well adapted for curving the retaining-wire G, or for modifying the curves in wire arches B and E. This may thus be done without risk of breaking or roughening the smooth surfaces of the wires, as is liable to occur under the use of ordinary pliers.

Section IV. Excessive Protrusion of the Lower Teeth.

Another well-defined type of irregularity is characterized by excessive prominence of the lower jaw, or orthognathism, and which in extreme cases presents the most noticeable deformity we are called upon to correct. Unlike the type last described, the inferior dental arch is generally large, and quite free from irregularity, while the upper arch is usually small and the teeth crowded, so that the inferior incisors close anterior to the superior, producing the greatest malocclusion of the remaining teeth. The

treatment varies according to the age of the patient. If begun at a proper age, as soon as the deformity is manifest, or even up to the twelfth or fourteenth year, it is not difficult to bring about retraction of the jaw by means of force exerted by the heavy elastic bands and head-cap (already described in connection with Set No. 2), attached to a metallic cap covering the chin, all as shown in Fig. 5.

Fig. 88.

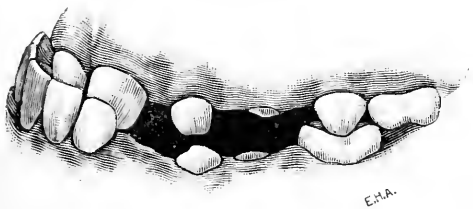
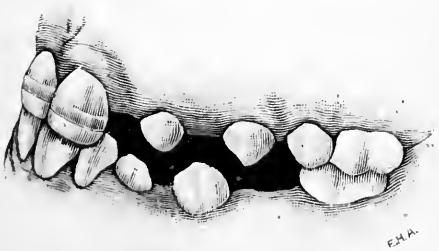


Fig. 88 represents the side view of a case of a child nine years of age. The permanent incisors of the lower jaw had erupted; the superior centrals had also erupted and were twisted nearly at right angles. The deciduous cuspids were in position, although the inferior were loosened and nearly ready to fall out. The four first permanent molars were present, and the first superior bicuspids were beginning to emerge from the gum. The jaw had moved forward so that the lower incisors closed anterior to the

Fig. 89.



superior, all as correctly represented in the engraving. The patient could not retract the jaw sufficiently to bring the cutting-edges of the incisors in contact at any point. The head-gear and chin-cap were worn almost constantly for six weeks.

Double rotation of the superior centrals was accomplished by means of the lever already described in double rotation (Fig. 34). They were retained by uniting the bands with solder and re-cementing them upon the teeth, and at the end of six weeks the jaw had been retracted into almost a normal position, presenting the appearance shown in Fig. 89. The chin-cap and head-gear

were worn at night-time only, and dispensed with after six months, as there was no further need of retractive force.

The first examination proved the patient to be suffering from

Fig. 90.

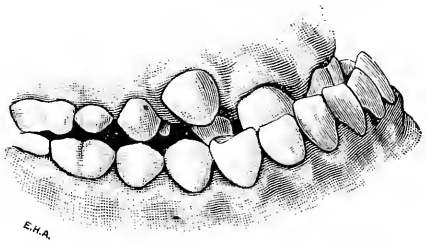


Fig. 91.

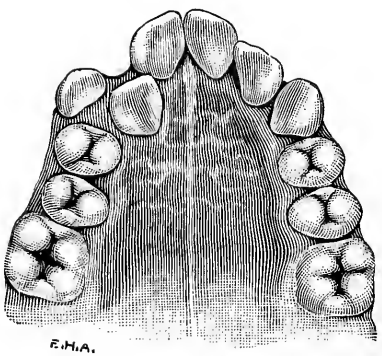
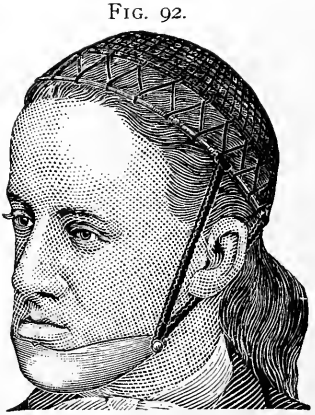


Fig. 92.



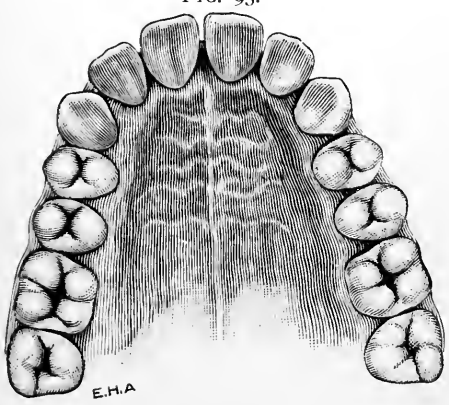
greatly enlarged tonsils, and she was referred to the rhinologist for treatment.

Fig. 90 shows a side view of another very marked case belong-

ing to this class of deformity. Fig. 91 accurately represents the upper arch. The effect of the deformity upon the appearance of the patient is shown in Fig. 92. The treatment consisted in enlarging the upper arch by means of the expansion-arch E, and anchor clamp-bands and tubes D, operated as shown in the case illustrated in Fig. 68. The expansion-arch was also reinforced as described on page 47 and illustrated by Fig. 44.

While this was being done, the head-gear and chin-retractor were worn as much of the time as possible. At the end of two months the expansion of the upper arch was discontinued, the teeth retained, and the patient allowed to return to her home in a distant city, for a vacation of three months. This was done in

FIG. 93.



order to give the upper jaw an opportunity to develop, but the wearing of the chin-retractor was continued faithfully. At the end of the three months the patient returned, and the expansion of the upper arch was continued, at the same time increasing the tension upon the chin. At the end of two months more the enlargement of the upper arch had been completed, and is truthfully represented in Fig. 93.

The lower jaw had been moved backward, and the occluded teeth presented the appearance shown in Fig. 94.

Exactly what changes had taken place in the angle of the jaw, or temporo-maxillary articulation, it is impossible to say, but I am thoroughly convinced that the body of the jaw had been moved backward greatly. The principal change, however, was the instrumental enlargement of the upper jaw. The improvement in the appearance of the young lady can be better imagined than described, and the changes that had been brought about were such

as to encourage attempts at improvement in all such cases. But in cases of advanced years, my experience is that it is useless to attempt the retraction of the jaw. All that we can then hope to accomplish is the contraction of the inferior dental arch and the enlargement of the superior, as illustrated by the case shown in

FIG. 94.

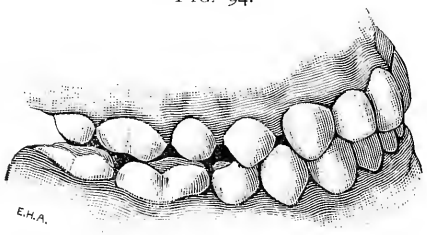


FIG. 95.

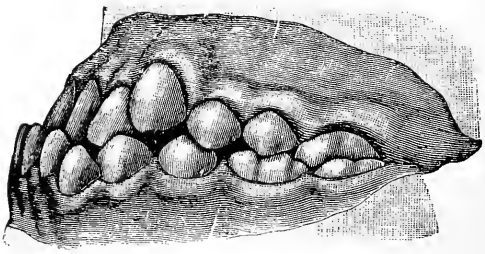


FIG. 96.

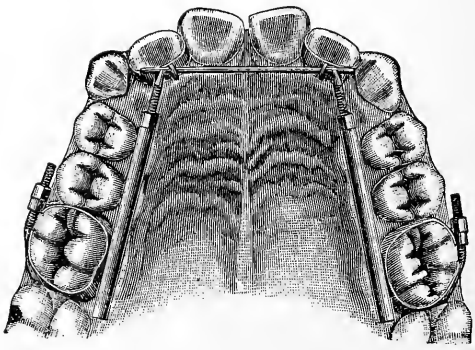
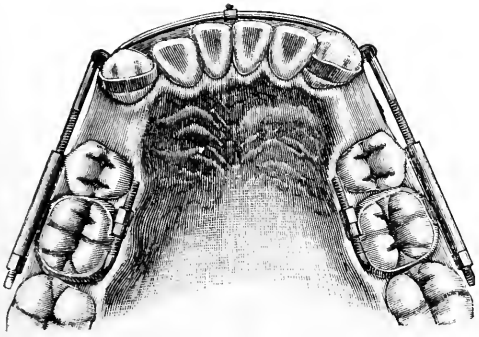


Fig. 95. The upper anterior teeth were moved outward by means of the jack-screws as shown in position upon the teeth in Fig. 96, and described in the treatment of a similar case on page 54. After the first bicuspids had been extracted, contraction of the anterior part of the inferior arch was accomplished by means of the trac-

tion-screws hooked into staples upon bands encircling the cuspids. The traction-screws were assisted in moving the cuspids and incisors backward by the head-gear, elastics, and traction-bar, exerting pressure upon a section of the wire arch B, Set No. 2, which rested in contact with the incisors and cuspids held in position by the attachment of the band to the ends with solder, all

Fig. 97.



as shown in Fig. 97. The external force served the double purpose of assisting the traction-screws in moving the teeth as well as in the retraction of the maxilla. The amount accomplished in the last-mentioned movement was quite noticeable, as is well shown in Fig. 98, which represents the completed case.

Fig. 98.

The new regulating pliers (H, Fig. 8 B) for elongating the several straight or curved wire appliances will be more and more appreciated as experience shall demonstrate the general utility of the invention. A re-examination of the devices shown in Figs. 10, 24, 25, 26, 37, 56, 70, and 71 will make obvious the fact that any section of the wire G, if inadvertently cut a little short for its designed position, may be repeatedly pinched with the pliers

until its length shall exactly correspond with its function. If desirable, the wire may be so stretched while *in situ,* as shown and described on page 51.

In the precise adjustment of retaining-wires the novel action of the regulating pliers is especially manifest.

CHAPTER VIII.

GENERAL SUGGESTIONS.

I. An essential preliminary to the treatment of a case is a clear conception of what is necessary. This can be gained only by a careful study of both models and natural teeth, occlusion and facial expression, history, etc.

II. It is best to first attend to the crowding teeth, rather than those most irregular. For example: If the molars and bicuspids are irregular, and expansion indicated, expand first and establish correct occlusion in that region, before correcting malpositions of the incisors and cuspids.

III. Have regular times for seeing the patient; be punctual, and insist upon punctuality by the patient. Always carefully compare the original models at each sitting.

IV. It is not enough to correct the malpositions of the teeth in one arch, but also to establish the correct occlusion of all the teeth and restore proper facial expression.

V. Exercise such care and judgment in the adjustment of the appliances that delays from slipping, breaking, or changes will be avoided.

VI. In moving a tooth, the best result is obtainable only by recognizing the regular and proper amount of force necessary to stimulate absorption. The practice of applying great force at irregular intervals serves only to defeat the desired object, for it retards absorption and restoration, causes unnecessary pain, excites inflammation, and thereby endangers pulp-life. It also strains the appliances, causing much delay and pain to the patient by repairs.

Whether the pressure be constant or irregular, a safe rule is to see that it in no instance exceeds a snug feeling, which is a true indication of the proper amount of force.

VII. When the screw is used in moving a tooth, and the

patient is an intelligent one, he may be provided with a wrench, and instructed to tighten the nut each morning, thus greatly economizing the time of both patient and operator; yet the patient should be seen at intervals; usually twice a week will be sufficient.

VIII. It is important that the patient shall observe care in brushing and cleansing the teeth while wearing the regulating appliances. If the appliances are kept properly cleansed, they will, in most instances, take on a beautiful bronze color, far more pleasing in appearance than when made of gold, besides possessing greater strength.

IX. Each succeeding year strengthens the conviction that extraction for space is a rare necessity, and moreover it is difficult to produce the best results without the full complement of teeth. With but few exceptions it will be found that the facial expression is too full when all the teeth are ideally arranged in the arches. The conservative method should be first, extraction last. Many cases are greatly complicated by the careless extraction of one or more teeth, in order to gain sufficient space. The author has never seen a case where the extraction of the first molar, one or more, has not been followed by more or less irregularity, sometimes of a very complicated nature. No one can long practice orthodontia without being impressed with the important relation that each tooth in either arch bears to all the rest, nor fail to note the disastrous results often following the loss of a single tooth.

X. Slight irregularities should be corrected, because the turning of a slightly twisted tooth, or the correction of any irregularity of the oral teeth, will not only improve their appearance and occlusion, but refine the whole facial expression.

XI. It is important to remember that the pressure should never be wholly relinquished. The movements of a tooth may be arrested as often as is necessary; but never, by the removal of pressure, allow the tooth to spring backward, thus interfering with the process of repair. Disregard of this principle (as has usually been necessary in the ordinary regulating appliances, the faulty principles on which their construction has been based necessitating their frequent removal for purposes of modification and cleansing) has been the occasion of nearly all the pain and soreness in regulating. If intelligently conducted, the movement of a tooth is painless.

XII. Another very important fact to be remembered is, that support and perfect rest are essential, after a tooth has been moved into the desired position.

XIII. In adopting this system the operator should carefully

study and thoroughly familiarize himself with the names and uses of all the parts of these appliances, which are supplied in sets or separately. A little experience will enable him to readily apply them to any case, for the system is complete in itself.

XIV. The plate has no place in this system as any part of a regulating appliance, and only in rare instances as a retainer after lateral expansion of the arch: it should be a relic of the past.

XV. The wire arches B and E have all the spring possible. They are, therefore, hard, and may be broken if care is not taken in bending to the desired shape. They are made long enough to include the largest arch, and may be cut to suit the smaller ones.

XVI. In applying the jack-screw, the sheath should be used as long as possible, turning the nut close up to the chisel end before cutting the sheath to the desired length.

XVII. In making the attachments of tubes, they should be grooved with a round file at the point of contact to make a strong, compact appliance.

XVIII. The motionless retention of the teeth is of great importance, but it will seldom be attained unless proper occlusion has been first established. A retaining appliance should be so delicate that it may be worn without inconvenience to the patient until perfect firmness has been established, and should rarely be under the control of the patient.

XIX. It is not necessary to separate the upper from the lower teeth by some contrivance while teeth are being moved out of inlock, so that the occlusion will not cause interference with the moving teeth. The author has never yet found it necessary, as the patient will invariably avoid biting upon the tender moving teeth.

XX. Failures to recognize and appreciate the artistic requirements in the treatment of dental irregularities are frequent, and as easily recognized as they are lasting. All who hope to attain success in the treatment of dental irregularities should cultivate the habit of observing and carefully studying the normal and abnormal lines of the human face, together with their relations to, and dependence upon, the teeth.

An appreciation and intelligent application of the principles of art must ever go hand in hand with the successful treatment of irregularities of the teeth.

XXI. Irregularities of the teeth being so frequently associated with some pathological obstruction of the nasal passages, or naso-pharynx, this fact should be ever present in the operator's mind and suitable examination be made; and in case (as is often found)

the oral deformity is complicated by the presence of hypertrophied faucial tonsils, adenoid hypertrophies in the vault of the pharynx, or obstruction of the nasal passages, the orthodontist's work can only be made complete by the assistance of the rhinologist and laryngologist.

XXII. If, however, a dentist, after sufficient experience, finds himself unsuited for this class of work, it is his duty to refer patients to an expert orthodontist, and thus promote the practice of this specialty in dental surgery.

PART II.

FRACTURES OF THE MAXILLÆ.

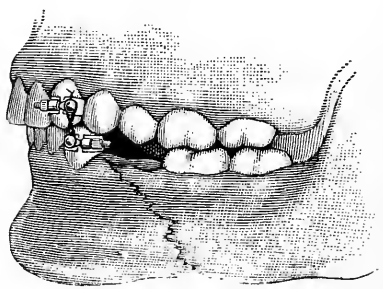
CHAPTER I.

TREATMENT OF FRACTURES OF THE MAXILLÆ.

THE limits of this work will not admit of a general discussion of this subject, nor is it deemed necessary, for almost any of the modern works on surgery contains a treatise covering the general principles of the treatment of fractures. Especially commendable is Hamilton on Fractures.

The most important consideration, after securing perfect apposition of the parts, is that they shall have uninterrupted rest, and this

FIG. 99.



phase of the subject will be set forth, strictly with reference to certain plans for securing fixation of the fractured maxillæ while undergoing the healing process; plans which are original with the author, and have been successfully employed in an extensive experience in the treatment of these lesions.

The first plan is that of firmly and immovably holding the injured jaw in contact with the firm and uninjured jaw, by means of wire ligatures wrapped in the form of the figure eight, around buttons attached to bands encircling suitable opposite or nearly opposite teeth, as shown in Fig. 99.

All the teeth are thus kept in perfect occlusion, and, as a result, the fractured ends of the bones must necessarily be in apposition,

so that the conditions are most favorable to the process of repair; for it will be apparent upon reflection, that no matter at what point the fracture has occurred, if the jaw contains sufficient teeth and they are placed in perfect occlusion, not only will the fracture be properly set, but the powerful muscles will be greatly relaxed and the parts be consequently freed from that tension and tendency to displacement, so difficult to combat in the treatment of fractures, in the long bones especially, or in the maxillæ when the jaws are kept apart, as is necessary when the heavy interdental splints are employed.

Indeed, we believe this plan to be a most natural and easy one, for the cusps of the teeth lock and interlace so perfectly that displacement in any direction is impossible, provided the jaws are kept closed. And in this we are further assisted by the natural contraction of the powerful muscles of mastication, it being necessary in most cases only to antagonize the anterior, feeble depressor muscles, by attachments on each side to the cuspids, or other teeth in this region, if more suitable.

The bands, which we term fracture-bands, Fig. 100, are made

FIG. 100.

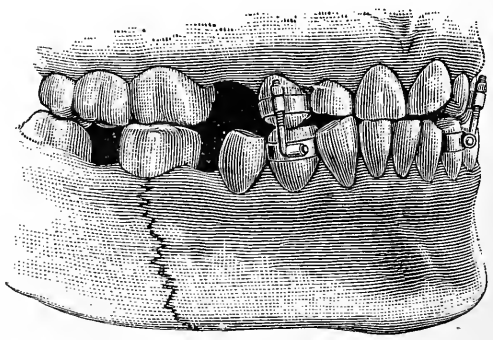
very thin and strong, are adjustable, and, by means of the screw and nut, they may be firmly clamped about the teeth. Little buttons, strong and of sufficient size to admit the requisite number of wraps of the ligatures, are firmly soldered to the band. Care should always be exercised to work the band well over the crown of the tooth and down upon the neck, then tighten the nut until the band is firmly clamped, being careful not to weaken the band by crimping or tearing. The fingers alone are usually sufficient, although a dull instrument and mallet (as in M and L, Fig. 8 B) may be used to assist in placing the band. If the teeth are crowded, a thin spatula pressed between them and allowed to remain for a few moments will provide ample space. For the ligatures, almost any of the usual materials may be employed, such as waxed floss silk, strong linen thread, or the gut ligature so extensively employed in surgery, but fine copper or brass wire thoroughly annealed (No. 26) is preferable on account of its strength, pliability, and cleanliness.

That the reader may become more familiar with this method of treatment, as well as with a few of the many modifications of which it is susceptible, reports of a few cases from practice are subjoined, with illustrations from models made accurately in each instance after treatment.

Case I.—The first is represented by Fig. 101.

On July 14, 1889, Wm. Fraley, aged forty-five, was admitted to the Minneapolis City Hospital. A blow from a policeman's club had produced one simple and one compound fracture of the inferior maxilla. The first was an oblique fracture on the right side, beginning with the socket of the second bicuspid, extending downward and backward, and involving the socket of the first molar. The second bicuspid had fallen out, and the first molar was much

FIG. 101.



loosened. The second molar had been lost years before, while the third molar and the remaining teeth were much abraded, and much loosened by salivary calculus. The second fracture was on the opposite side, high up in the ramus of the jaw. I could not detect the exact course the line of fracture had taken, but the crepitation of the ends of the bones, and the pain occasioned thereby, were unmistakable evidences of a fracture. The patient, as is usual in such cases, was unable to close his jaws. The fractured parts on the right side were widely separated, and the anterior piece much depressed by reason of the action of the digastric muscle, the posterior piece of bone being drawn firmly up, and the molars occluding by reason of the contraction of the masseter muscle. He was treated as follows:

Bands were made to encircle all four of the cuspids (they being most firmly attached in their sockets). The fractured ends of the

bones were placed in careful apposition, and the lower jaw closed, the lower teeth being correctly occluded with the upper.

The points on the bands, where the little tubes (C, Set No. 1) shown in the engraving should be attached, were carefully noted and marked. The bands were slipped off and the tubes soldered to them, after which the bands were cemented in proper position upon the teeth, and two small traction-screws (B, Fig. 1), shown in the engraving, inserted in the tubes. The jaws were closed and the nuts tightened.

During an attack of coughing the following night, one of the bands was loosened, but it was easily replaced the next day. No further accident or trouble occurred, the patient readily taking nourishment through the spaces between the teeth. Thus the fractured jaw was firmly supported without motion for twenty-two days, when the appliance was removed, showing most excellent results.

That the patient was a great lover of the clay pipe is shown in the engraving, by the much worn ends of the lateral incisors, which resulted from holding the stem of the pipe. While wearing the appliance he was not debarred from his favorite enjoyment, although compelled to grasp the stem between his lips instead of the teeth.

Case II.—December 28, 1889, Thomas Bremen was admitted to the Dental Infirmary of the University of Minnesota, suffering from the effects of a blow received on the left side of the jaw from a cant hook, while working in a lumber camp. The result was two fractures of the jaw.

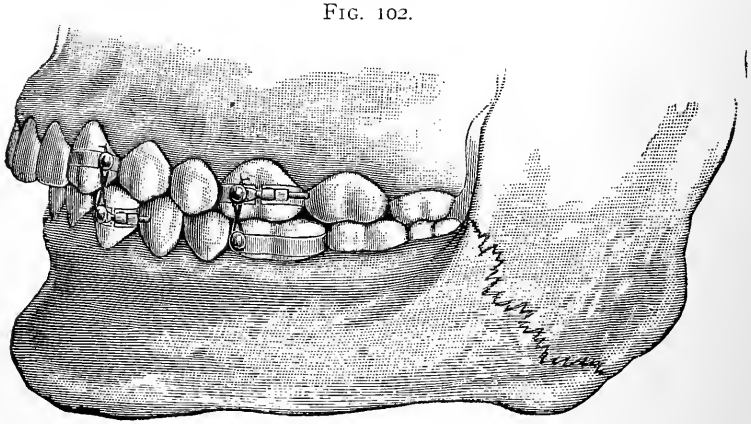
The first fracture was on the right side, beginning between the first and second bicuspids, and extending downward and backward so far as to involve the lower part of the anterior root of the first molar. The second was on the left side directly through the angle of the jaw (see Fig. 102). The accident had occurred thirty-two days previous to his admission to the infirmary, during which time nothing had been done to reduce the fracture. He reported that he had called upon a physician, who supposed the trouble was merely an abscessed tooth, and had lanced the gum with a view of reducing the swelling. Later, the patient had called upon a dentist in one of the smaller towns, who also failed to diagnose the fracture, and extracted *both* bicuspids in the hope of giving relief (see Fig. 99).

Upon examination, I found considerable swelling in the region of the fracture, with the usual result: the patient being unable to close his mouth, by reason of the anterior piece of the fractured

bone being drawn down by the depressor muscles. A false joint had also become established, and could be easily moved without causing pain. At the fracture of the right side there was but little displacement; the swelling also was slight.

The patient was anesthetized, and, with a view to breaking up the false attachments and stimulating activity in repair, the ends of the bones rubbed forcibly together, placed in perfect apposition and the jaw closed, great care being taken to articulate the teeth correctly with the upper ones. The jaw was now firmly bound in this position in the same manner as described and shown in Fig. 99, which is quite as efficient and much easier to adjust. Four bands were used, encircling the four cuspids as shown in Fig. 102.

FIG. 102.



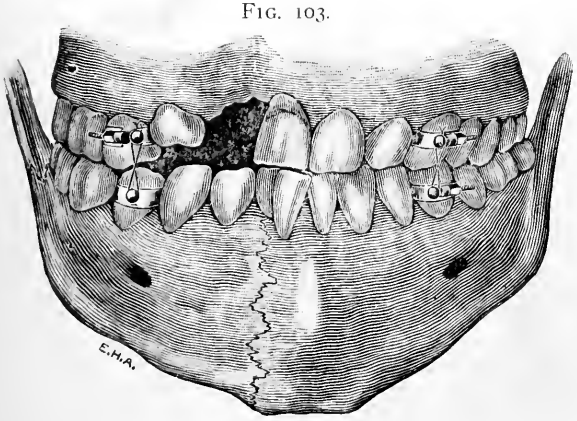
The bands shown upon the molars in the engraving were not used, as I found them unnecessary, since the jaws were firmly supported by the four anterior bands alone.

Case No. 3 is represented by Fig. 103, and is that of a healthy young Swede, twenty-two years of age, who, while washing windows, had fallen from the second story to the hard pavement. Besides receiving several minor injuries he sustained a double fracture of the lower jaw, one extending from between the central incisors, and one posterior to the second molar, the third molar having been extracted. The right superior lateral and cuspid were knocked out, the first bicuspid broken off near the neck, and the alveolar process badly shattered. The centrals and left lateral were bent inward and forced deeper into their sockets. He had been treated by the attending physician at the City Hospital, the method employed being that of the Barton style of bandaging, with the usual result, when the bandage is employed in such cases, of aggra-

vating the condition by forcing the pieces inward and the jaw backward.

Upon examination three weeks after the accident, I found much displacement. The jaw was drawn backward and the right middle section of the bone tipped inward. No attention had been paid to the bent and broken condition of the superior alveoli. The teeth had become quite firm in their new, but abnormal positions, and I allowed them to remain so. A fibrous attachment had been established in the lower fracture, which admitted of considerable movement, and occasioned but little pain. There was much swelling, and pus was discharging into the mouth from the anterior fracture. I found it impossible to restore normal occlusion at that

FIG. 103.



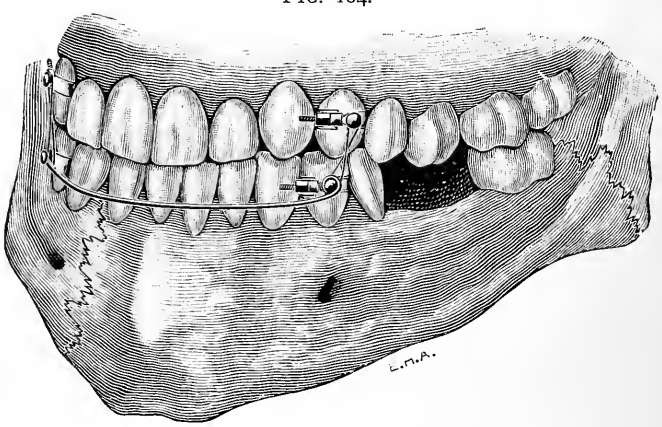
time. Bands were made to encircle the four bicuspids, and between the two lower bands, on the inside of the mouth, was placed one of the jack-screws (E and J, Set No. 1), held in place by the staple and spur (E, Fig. 21, and B, Fig. 20). The nut was tightened until the piece of bone had been tipped outward about one-half the distance to its normal position, but the operation caused so much pain that further movement was deferred. The jaws were then closed and the buttons connected by ligatures, but occlusion was far from being normal. On the next day, by again tightening the nut on the jack-screw and with renewed ligatures bound very tightly, I was enabled to secure nearly the normal occlusion. On the third day following, by the same means, correct occlusion was established. The jack-screw was allowed to remain in position to steady the tipping section.

The abscess was frequently syringed with fresh peroxid of hydrogen. A few fragments of bone were washed out. The fractures

readily united, and on the twenty-seventh day the jaw was released and found to be quite firm.

Case No. 4 shows another modification, and is represented by Fig. 104. A young machinist received a severe blow from the fist of an antagonist, by which two compound fractures were sustained; one posterior to the first molar, the other in the region of the cuspid, which was involved and greatly loosened. Occlusion was established and maintained in the previously described way. Suppuration occurred in both fractures on about the tenth day, and received proper treatment. The union of the anterior fragment was slow, as the patient was troubled by a persistent hacking cough, which occasioned a slight movement between the ends of the bone, just sufficient to interfere with the healing process. On

FIG. 104.

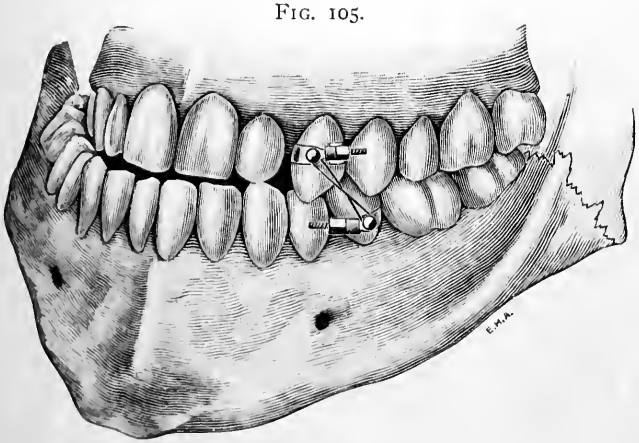


the twentieth day the ligatures were cut, a jack-screw placed in position between the bands on the inside in the same manner as in Fig. 103, with an additional ligature firmly connecting the two buttons on the lower bands, and resting in contact with the labial surfaces of the intervening teeth. This additional support proved successful; the union proceeded slowly, and was found complete when the bands were removed on the sixty-second day after the accident.

Another modification is shown in a somewhat peculiar case, represented in Fig. 105. The patient, a man of about forty years of age, had sustained a complete fracture of the left angle of the jaw, as the result of a kick from a horse. The jaw was enormously large and protruding, and the occlusion so unusually faulty that I was at a loss to determine what the patient's normal occlusion was;

but upon questioning him, he informed me that when a boy of ten years he had been hit with a stone, causing a fracture on the right side of the jaw, which had been allowed to heal without any treatment. This statement, with the worn facets upon the cusps of some of the teeth, and the readiness with which they occluded only at these points, showed conclusively the position in which the jaw must be secured. I at first, of course, supposed that the usual number of four bands and two ligatures would be necessary, but I found the single ligature, as shown, was quite sufficient to firmly retain the jaw in this abnormally normal position. The jaw was set a few hours after the accident. Very little swelling ensued, the fractured parts uniting rapidly. I saw the patient but four times, and removed the bands on the twentieth day, as further support

FIG. 105.



seemed unnecessary. I admonished him, however, to avoid using his jaw as much as possible for at least ten days thereafter.

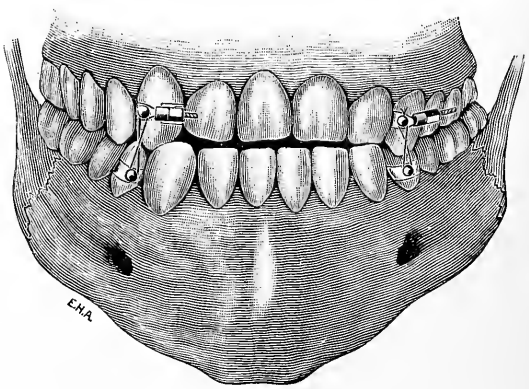
Fig. 106 represents a case where the patient suffered in a railroad wreck two compound fractures of the inferior maxilla, one on each side, posterior to the second molar. The left side was quite badly comminuted. The full complement of teeth was present, with the exception of the third molars. The occlusion of all the teeth was excellent. The incisors, however, were crossed (not well shown in this engraving); that is, the left superior central and lateral closed just inside of the points of the lower incisor and cuspid, while the right central and lateral closed just outside of the points of the opposing lower cuspid, central, and lateral.

The teeth being so perfect and the occlusion so accurate, liquid foods only were possible. The conditions were made more un-

favorable on account of the patient suffering from severe spinal injury received at the time of the accident, but with the exception of considerable suppuration in the left fracture, which yielded readily to treatment, nothing unusual occurred. The ligatures were removed on the fortieth day, and excellent results were apparent.

It might be urged against a method of treatment which involves the closure of the teeth and the binding of the jaws firmly together, that the patient would be unable to take sufficient nourishment. Experience, however, shows that this argument has practically no foundation, for it rarely happens that a patient is found without some missing teeth, thereby providing abundant opportunity for the inception of all ordinary chopped foods, and more especially

FIG. 106.

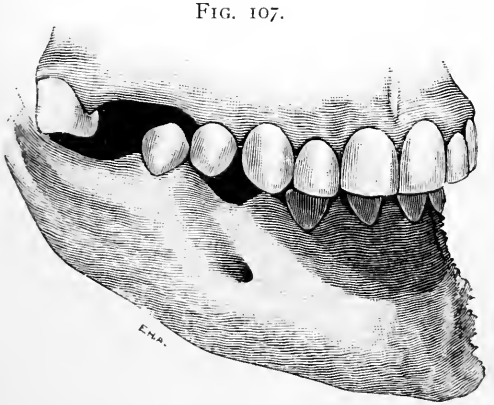


for the large number of foods now available in liquid form. Even when all the teeth are sound and in perfect position, there is plenty of space between the teeth, or behind the molars and between the upper and lower incisors, for taking all the nourishment necessary. Of course, in these rare cases more time would be required for eating. This inconvenience is very slight when we consider the advantages of freedom from an uncleanly, bulky, and inconvenient apparatus within the mouth, often accompanied by the disfigurement of bandages and splints without, as well as the great importance of the accuracy in results which it assures, so uncertain of attainment in many other methods commonly employed.

There is also another class of lesions in the treatment of which this plan of fixation may be employed to great advantage. I refer to excision of the lower maxilla, or those cases where a large portion of the jaw has been removed, as in Fig. 107.

In all these cases there is a strong tendency for the remaining portion of the jaw to be drawn greatly to one side (about three-quarters of an inch, by actual measurement, in the case represented), due to the contraction of the cicatricial tissues following the healing of the wound. The plan I propose will prevent this contraction, by securing the remaining portion of the jaw in proper occlusion, by means of the fracture-bands and ligatures in the manner already described. The jaw thus firmly held will exert sufficient tension upon the healing muscles to prevent their contraction. I would also suggest the advisability of increasing the tension by the attachment of a plumper, by means of a clamp-band, to one of the molars in the upper jaw on the side from which the section has been removed, allowing the shield or plumper to extend downward and outward, to occupy somewhat the position

FIG. 107.



of the missing bone. This shield may also serve a useful purpose in holding in better position the dressing of the wound.

The next plan may be said to be a modification of, or an improvement upon, the plan advocated by Hippocrates in the fifth century B.C., and which has been employed from that time to this. It consists in holding the fractured ends of the bone in apposition by wrapping ligatures about the teeth, or, as physicians now term it, wiring the teeth. The principal disadvantage has always been the slipping of the ligatures, which produced displacement of the bones, and caused inflammation by the pressure of the sliding ligature upon the gums.

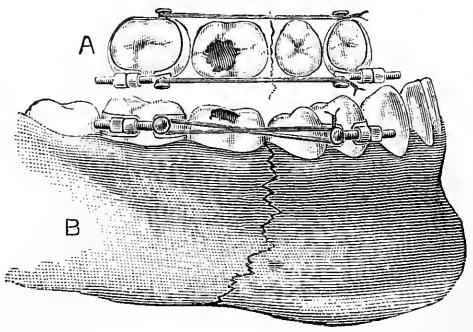
My plan is shown in Fig. 108, and consists in encircling suitable teeth with fracture-bands and attaching ligatures to the buttons upon the bands, so that loosening of the bones or pressure upon the gums is impossible.

A modification of the plan is shown in Fig. 109, in which additional support is secured by connecting the labial and lingual wire ligatures by loops of wire passed between the teeth, with their ends united by twisting.

In favorable cases, as in simple transverse fractures with little or no displacement and where the teeth are very firm, if the apparatus is adjusted with skill, the plan will be found valuable, as it is very neat, clean, and compact, and does not interfere with the freedom of the jaw.

A few suggestions may assist the inexperienced in the adjustment of the apparatus, so that it will surely afford equal pressure and support upon the intervening teeth. The only difficulty is in regard to the proper length of the lingual ligature when completed.

FIG. 108.

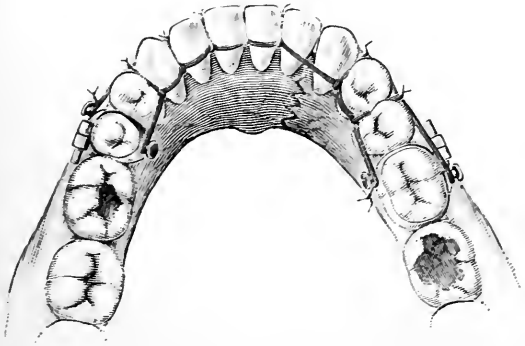


This is easily overcome by using two small copper wires, passing respectively above and below the buttons and extending beyond them a half-inch or more at each end. Tension is not exerted on the buttons by uniting the ends by twisting until *after* the external and transverse ligatures have been completed. The engraving is incorrect in this respect, that only one end of the lingual ligature shows union of the ends, instead of both.

Fig. 110 represents a modification of this plan used for holding in position a large section of the inferior alveolus, including the incisors and left cuspid, which had been broken outward as the result of falling from a sled while the individual was coasting with the knotted end of a rope held in the mouth. The second bicuspids were banded, and a wire ligature made to encircle the buttons and bear against the loosened teeth. The ligatures showed a slight tendency to slide down and impinge upon the gum, but this was easily remedied by encircling the main ligature and the incisors with two or three fine wire ligatures, thus giving additional support in a downward direction.

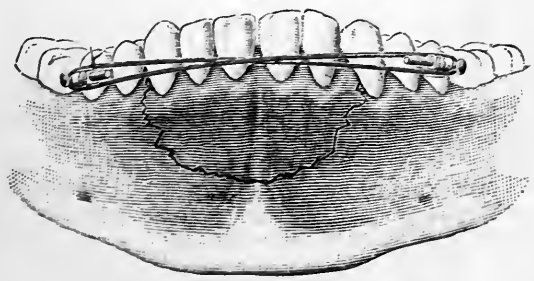
Fig. 111 shows another plan for securing fixation which possesses several valuable features. It is a thin metal cap, swaged to fit the crowns accurately and covering a sufficient number of the teeth in the arch to afford the necessary support, the whole being firmly cemented to the teeth with oxyphosphate of zinc. Copper, gold, silver, aluminum, or vulcanite may be used; my

Fig. 109.



preference is aluminum. The plan is excellent, in that it allows freedom of the jaw, is very clean and compact, and retains the fractured ends of the bone firmly in apposition. Considering the simplicity of this appliance, and the familiarity of dentists with oxyphosphate of zinc, it is surprising that the value of this idea in

Fig. 110.

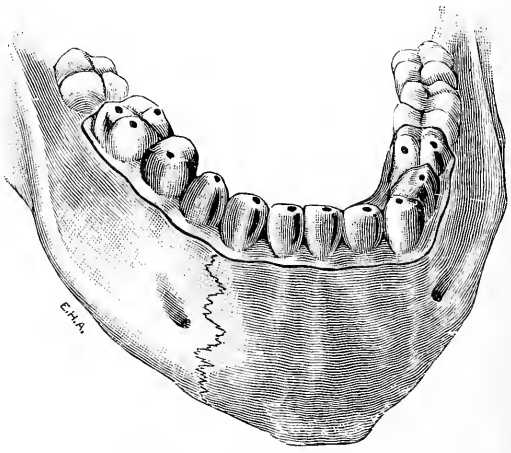


treating fractures has not been before recognized; but I find no record of its use, although dentists frequently use similar splints in the retention of teeth after they have been regulated, and Hullihen employed a similar device in 1848 to hold the section of a jaw after a surgical operation, using ligatures to keep the appliance in place.

For several years I supposed I had been the first to employ

this method of retaining fractures, but I now believe it was first used by Dr. John H. Martindale, of Minneapolis, who preceded me a year or so, by cementing in position a splint made after Kingsley's pattern, in order to dispense with the submental cap

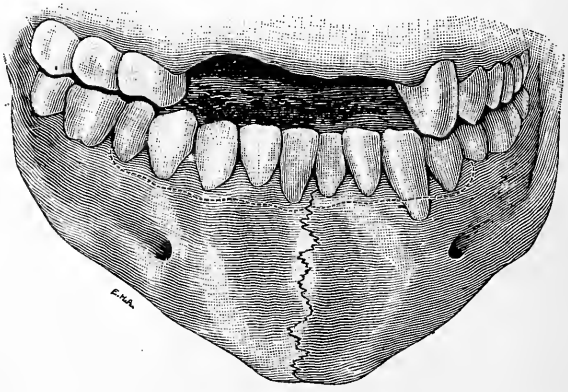
Fig. 111.



and bandages, which would interfere with the treatment of serious external wounds on the side of the face.

My first case treated after this method is shown in Fig. 112. Michael P., a baker by trade, had fallen down-stairs, knocking

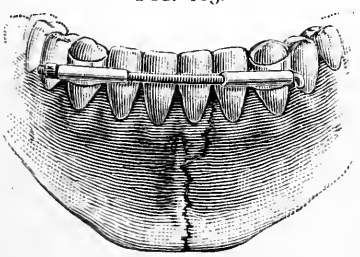
Fig. 112.



out the superior incisors, cuspids, and one bicuspid, also loosening the lower central incisors and fracturing the jaw at the symphysis. As I remember, he also received a fracture of one of the femurs. He was admitted to the Minneapolis City Hos-

pital some time in June, 1888. I saw him first some two months after the accident occurred, during which time the attending surgeon had employed the Barton style of bandaging in treatment. Union of the bone had not taken place; on the contrary, a complete fibrous joint had been established, with the ends of the bones more or less absorbed and rounded, admitting of a free hinge movement, with pus discharging, for which a large rubber drainage-tube had been inserted. The tube was removed, the wound thoroughly washed, and an impression taken without any attempt at changing the collapsed condition of the sides of the arch. A model was made and sawed through at the point of fracture. It was then placed in the articulator and adjusted to restore the original occlusion as nearly as possible. Over this readjusted model a very thin vulcanite splint was formed, the outlines of which correspond to the dotted lines in the engraving.

FIG. 113.



The first attempt at cementing it in position upon the teeth was unsuccessful, the cement hardening too rapidly, but the next proved successful. The splint remained in position without any trouble for nearly four months, when it worked loose, and we found, upon examination, that firm union had taken place.

Of course the range of usefulness of this splint is quite limited, as a sufficient number of firm teeth must be present on each side of the fracture. Its principal value will, I think, be found in treating fractures in the anterior part of the jaw, more especially in that class of cases resulting from gunshot wounds in which large sections of the alveolus have been carried away.

Another plan which I have made use of in a few favorable cases with much satisfaction is shown in Fig. 113, which represents my first case treated by the method in question. On May 29, 1889, a young man of twenty-one years was admitted to the St. Anthony Hospital of Minneapolis. During an attack of epilepsy he had fallen from a lumber pile to the ground, a distance of fifteen or

twenty feet. Besides receiving severe bruises, he sustained a compound fracture at the symphysis, terminating in front between the central and lateral, as shown by the line in the engraving. The fractured bone, when first seen, was quite widely separated at the top, and the left central incisor was much loosened. He was treated as follows: The ends of the fractured bones were carefully placed in apposition and temporarily fastened by lacing the teeth together with silk ligatures. The cuspids, being very firm, were carefully fitted with plain bands. Tubes were soldered to these bands horizontally. The large traction-screw shown at A, Fig. 1, was now slipped through the tubes, and the bands were firmly cemented in position upon the teeth. The nut was then turned upon the screw until the fractured ends of the bones were drawn snugly together. This appliance was worn without displacement or further trouble for twenty-one days, when it was removed, the bones having become firmly united.

I may add that during the time the appliance was worn, so firmly was the jaw supported that the patient suffered but little inconvenience, and after the third day, partook regularly of his meals, using his jaws freely, but of course avoiding the very hard foods.

CHAPTER II.

FINAL SUGGESTIONS ON FRACTURES.

In adjusting bands for the treatment of a fracture, carefully consider the direction in which to exert the proper pressure for securing the jaw. It usually happens in cases of fracture that the muscles in contracting tend not only to depress the jaw, but to draw it backward, especially if the fracture be in the region of the last molar. Consequently such teeth for anchorage should be selected as shall use pressure not only upward but forward, as in Fig. 105.

This is only a general rule, however, but I would specially advise that the direction of force necessary in each case should be carefully considered, and then the bands and buttons be adjusted accordingly.

Sometimes it is an advantage to band more than one tooth in order to distribute the power exactly in the direction necessary. Should any of the teeth which have been selected for anchorage show a tendency to elongation, the bands should be shifted to

other teeth, or the direction of the force be changed. In but two instances have I noted this complication, and I am inclined to believe that one of the cases was due to the band slipping and impinging upon the gum, and thus probably producing the same result as when a ligature is carelessly left about the tooth.

Should it be found advisable to employ the plan illustrated by Fig. 112 or Fig. 113 in the treatment of a case, it will sometimes be found an advantage to support the jaw by the first plan (Fig. 99), for a few days, or until the wounds are in more favorable condition for taking an impression or adjusting the apparatus.

After the jaw has been properly set, the muscles relax in a few hours so that the strain upon the ligature and anchor-tooth is slight.

Very often patients receive severe bruises and internal injuries at the time the fracture is sustained, and these may occasion vomiting, more or less violent. Therefore especial caution should be observed that the securing of the jaw be delayed until all tendency to nausea has subsided. Be in no haste, for I know of no ill effects from a few hours' or even days' delay in setting a fracture. Should it be advisable to immediately set the fracture, it might be well to provide the attendant with a pair of strong scissors to cut the ligatures if symptoms of nausea develop.

It should require but little argument to impress the importance of extreme cleanliness about the mouth during the treatment of fractures. Frequent rinsing of the mouth with proper antiseptic solutions should be insisted upon. If the fracture is more or less comminuted, as is frequently the case, suppuration may be expected. The plan, then, which has been most successful with me, is extra cleanliness of the wound by frequent injections of pure, fresh peroxid of hydrogen with a suitable syringe. The patient or the attendant, with a little experience, can accomplish this quite as well as the surgeon. Patience and persistence in this line will soon cause the necrotic fragments to be washed out. Only in one instance, in my experience, has it seemed necessary to interfere with the wound by scraping the bone with instruments.

While the patient is undergoing treatment, his general health should also not be allowed to become impaired. Plenty of exercise in the open air, if other injuries do not prevent, should be insisted upon, as well as a requisite amount of nourishing food, and the surgeon should occasionally inspect the bands and ligatures, to see that they are in order, so that the jaw shall not be allowed to get loose, admitting movement between the fractured ends of the bones. Should one of the bones become broken, it

should be replaced as quickly as possible. No special harm will come from cutting the ligatures and separating the jaws, for the purpose of replacing it.

In cases where a section of the bone shows a tendency to lean, so that the teeth do not properly occlude, a finger of metal made to bear against a tooth in the leaning section and soldered to a band encircling some favorably located anchor-tooth, will effectually restore the proper occlusion.

In like manner the range of application of this method of retaining fractures may be extended to cases where fractures occur in the body of the bone and the molars are absent. The edentulous portion of the jaw may be securely held in proper position by a prop made to bear against the section of bone, and kept in place by attachment to a band secured about one of the molars or bicuspids in the upper jaw.

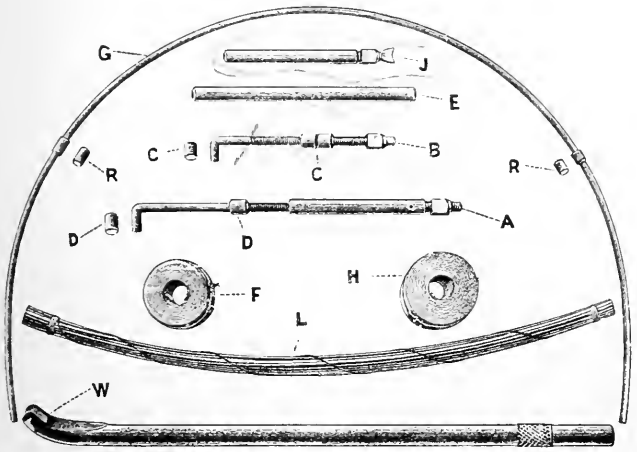
The methods so far offered will, I believe, nearly cover the entire range of cases requiring treatment. There still remains, however, one distinct class for consideration, namely: the edentulous patient. Fortunately, patients of this class requiring treatment are exceedingly rare, and probably the best plan is the Gunning splint, or what is the same in principle, attaching together by wire or vulcanite the artificial dentures, should the patient possess them.

The cases of fractures so far described have been confined to the inferior maxilla. The methods, however, of securing fixation are all more or less applicable to the treatment of fractures in the upper jaw as well, though I believe the one first described is most applicable; for the reason that, if one of the superior maxillary bones is fractured, it will be more or less displaced and usually forced downward. After carefully replacing the pieces, the jaws are closed and the teeth articulated, and the pieces thus supported and held upward in position by the lower jaw secured in the usual way by bands, buttons, and ligatures, attached on the uninjured side.

Finally, as all the apparatus possessing any special merit in the treatment of fractures of the maxillæ have been invented by dentists, and their familiarity with the parts, special knowledge of mechanics, and facilities at their command fit them above all other surgeons for this work, I would recommend that the different dental societies throughout the country shall secure appointments of competent dentists, in all hospitals, for the treatment of these lesions, for to them this special line of surgery justly belongs.

SET No. 1.

Patented March 5, 1889.



PRICES.

Set No. 1, complete (including 100 page descriptive Book).....$5.00

PARTS SEPARATE:

Traction Screw "A" and "D"	$1.25
" " "B" and "C"	1.00
Jack-Screw "E" and "J"	1.00
Coils of Band Material "F" and "H" each	.50
Retaining Wire "G"	.50
Rotating Levers "L" per ½ doz.	.25
Retaining Pipes "R" set of ten	.75
Wrench each	.15

EXTRA PARTS.

Adjustable Clamp Bands for Bicuspids and Molars.

FIG. 1. Bicuspid.

FIG. 2. Molar.

FIG. 3. Bicuspid.

FIG. 4. Molar.

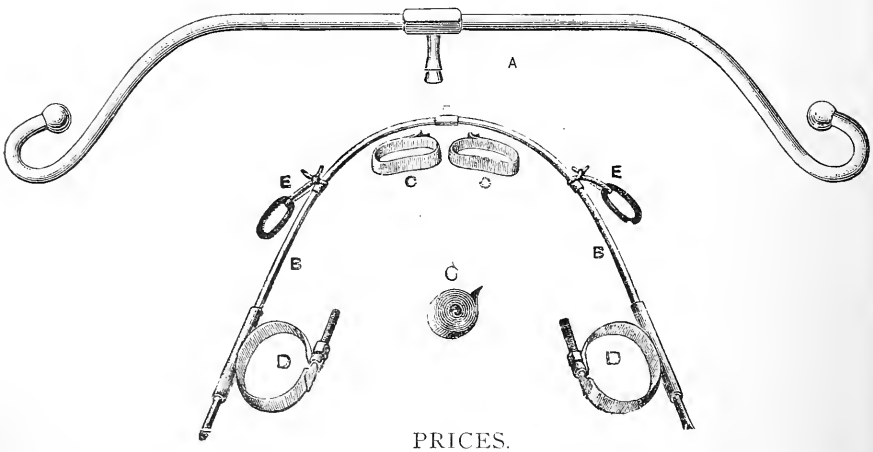
PRICES.

Adjustable Bands Nos. 1 and 2 each	$1.00
" Fracture Bands Nos. 3 and 4 "	1.10

THE S. S. WHITE DENTAL MFG. CO., Sole Agent.

SET No. 2.

Patented Nov. 6, 1889.



PRICES.

Set No. 2, complete (including 100 page descriptive Book).....$6.50

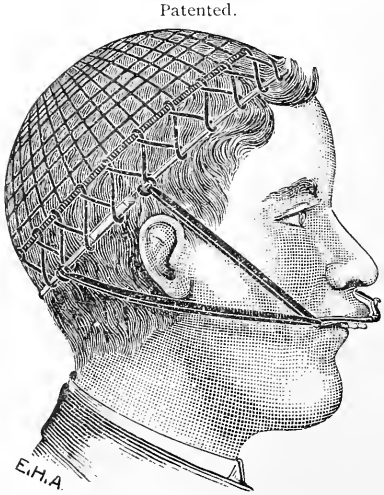
PARTS SEPARATE:

Traction Bar "A"	each	$2.00
Wire Arch "B"	"	1.50
Two Anchor Bands and Pipes "D," complete	"	1.50
Coils of Band Material	"	.50
Heavy Elastic Bands	set of six	.10
Wrench	each	.15

EXTRA PARTS.

Head Gear.

Patented.



PRICE.

Head Gear, with Heavy Elastic Bands.....each $4.00

The cut shows the Traction Bar "A," not included in price.

THE S. S. WHITE DENTAL MFG. CO., Sole Agent.

EXTRA PARTS.

Chin Retractor.

PRICE.

Chin Retractor (without Head Gear).....each $2.50

EXPANSION ARCH.

PRICE.

Expansion Arch.....each $1.50

THE S. S. WHITE DENTAL MFG. CO., Sole Agent.

ANNEALED WIRE.

For Ligatures in Regulating.

Dr. Angle remarks that spring wire will not do. We offer Annealed Wire, in Copper and Brass, and of the gauges he prescribes (Nos. 26 and 28, B. & S.).

Put up in quarter-lb. Spools.

PRICE.

Per Spool.....$0.20

(See Fig. 8 B, and pages 20 and 49.)

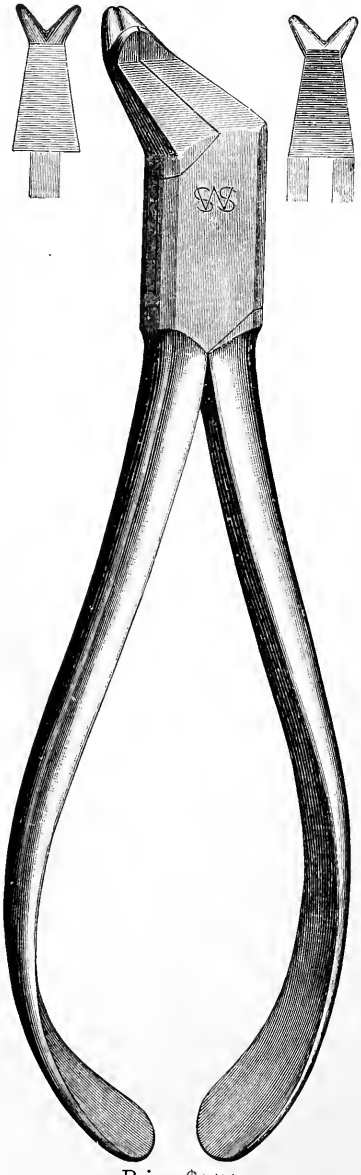
Regulating Pliers.

Patented March 19, 1895.

(See Fig. 8 B, and page 15.)

Band Driver.

Price, 20 cents.



Price, $3.75.

(See Fig. 8 A, and page 20.)

Annealing Pliers.

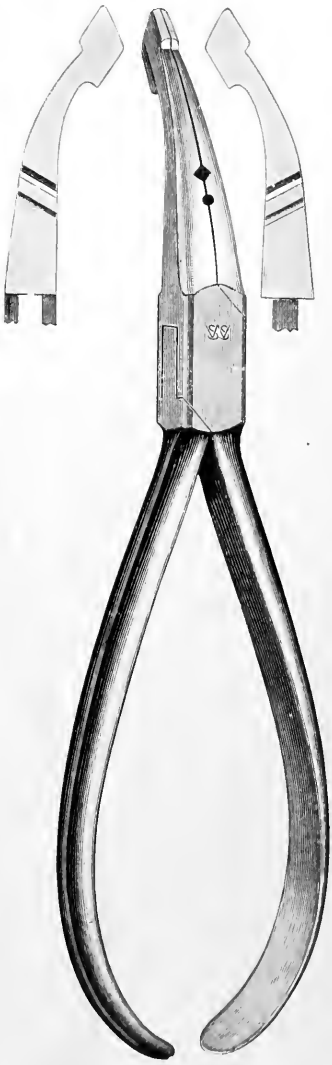
No. 12.
Price, $1.00

THE S. S. WHITE DENTAL MFG. CO.

BAND-FORMING PLIERS.

Patented September 13, 1898.

Designed by DR. EDWARD H. ANGLE.

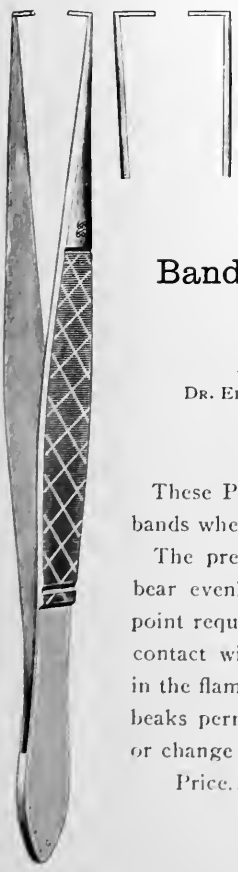


The Band-Forming Pliers are made especially for pinching or forming the plain bands about the crowns of teeth in regulating, and about roots in crowning.

The angle of the beaks and plurality of operating edges make them equally adapted to forming the seam upon the lingual or labial surfaces of the teeth in either jaw without requiring a cramped position of the hand.

Between the beaks are square and round grooves for holding wire, nuts, etc.

Price..... $2.25



Band Soldering Pliers.

Designed by
DR. EDWARD H. ANGLE.

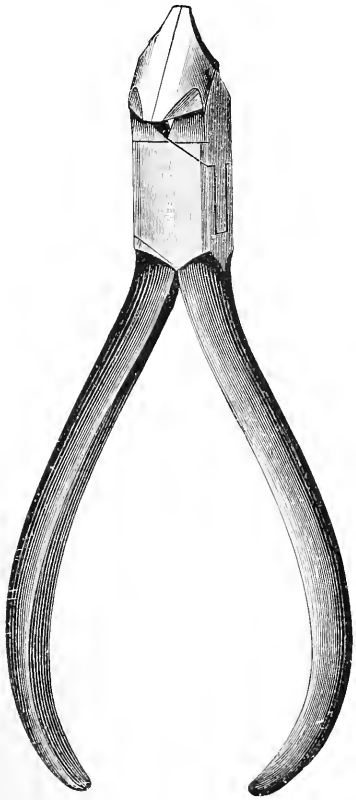
These Pliers are for holding bands when soldering.

The pressure is brought to bear evenly and at the exact point required, and away from contact with the solder while in the flame. The angle of the beaks permits the least absorption of heat, and without injury or change of form.

Price..... $0.70

(See Fig. 8 A, and page 20.)

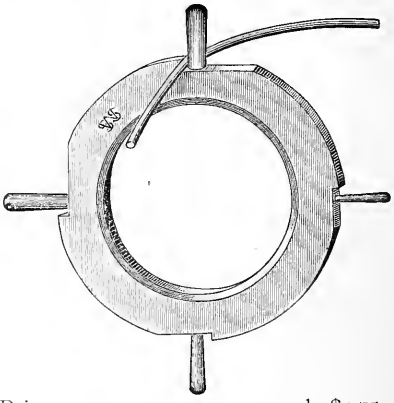
Solid Steel Cutting Nippers.



Price, Plain.....per pair $0.80
" Nickel-plated.... " 1.00

(See Fig. 8 A, and page 80.)

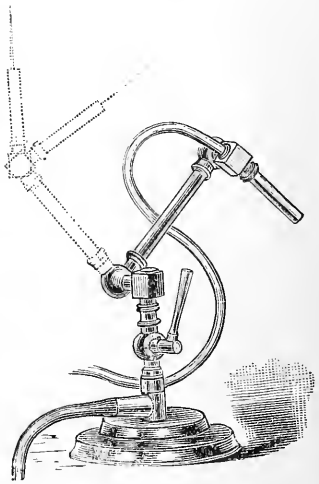
Spring Wire Coiler and Bender.



Price.....each $1.75

(See Fig. 8 B, and page 21.)

Herapath Blow-Pipe.

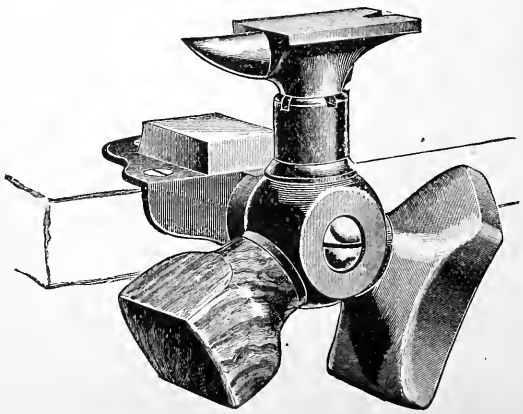


Price.....each $3.75

(See Fig. 8 B, and page 20.)

Melotte's Combination Anvil and Bench-Block.

Patented September 13, 1892.

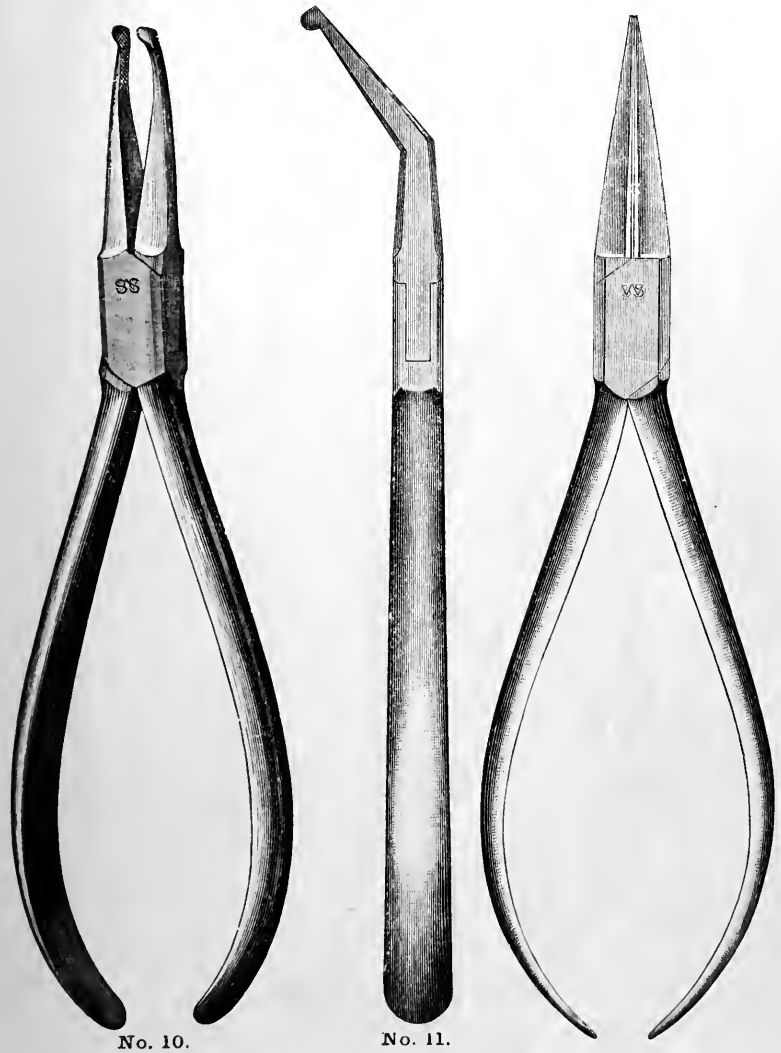


Price.....each $3.00

How's Crown Pliers.

Laboratory and Office Pliers.

(See Fig. 8 A, and pages 17 and 20.)



No. 10. No. 11.

Nos. 10 and 11, straight and curved Pliers for bending pins over posts in Dr. How's process of mounting artificial tooth-crowns.

PRICES.

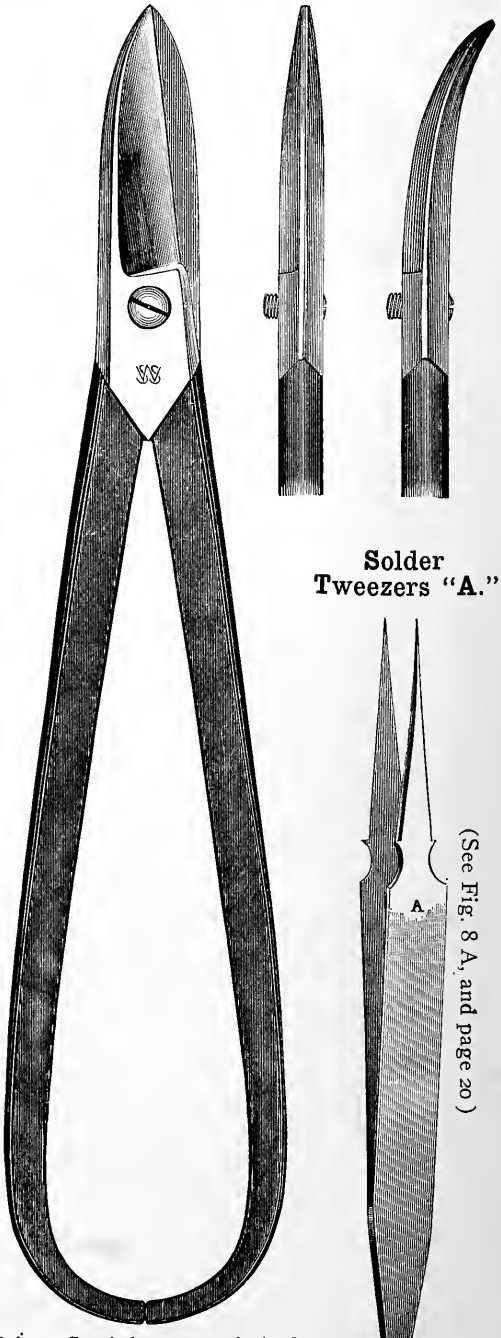
No. 10, Nickel-plated, Straight $1.50
No. 11, Nickel-plated, Curved 1.75

A pair of neat, well-made long-nose Pliers, which find many uses in office and laboratory. Steel throughout; nickeled all over.

Price.....per pair $1.50

(See Fig. 8 A, and page 17.)

Plate Shears for Crown- and Bridge-Work.



Prices, Straight..per pair $0.60
" Curved... " .85

No. 1.

Lignum Vitæ or Iron-Wood Head.

Rosewood Handle.
Length, 10½ inches.
Price.....each $0.30

Solder Tweezers "A."

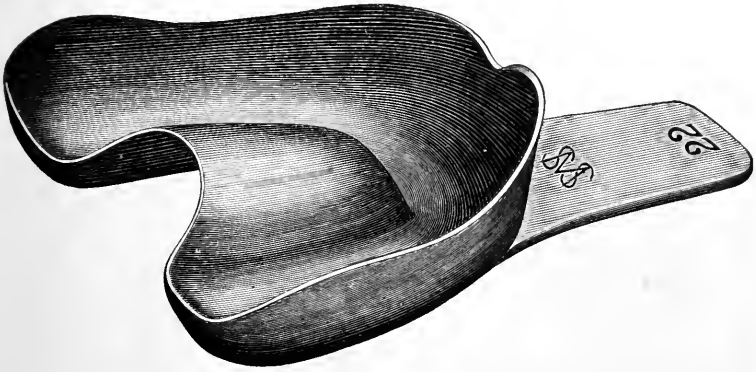
Price, $0.25

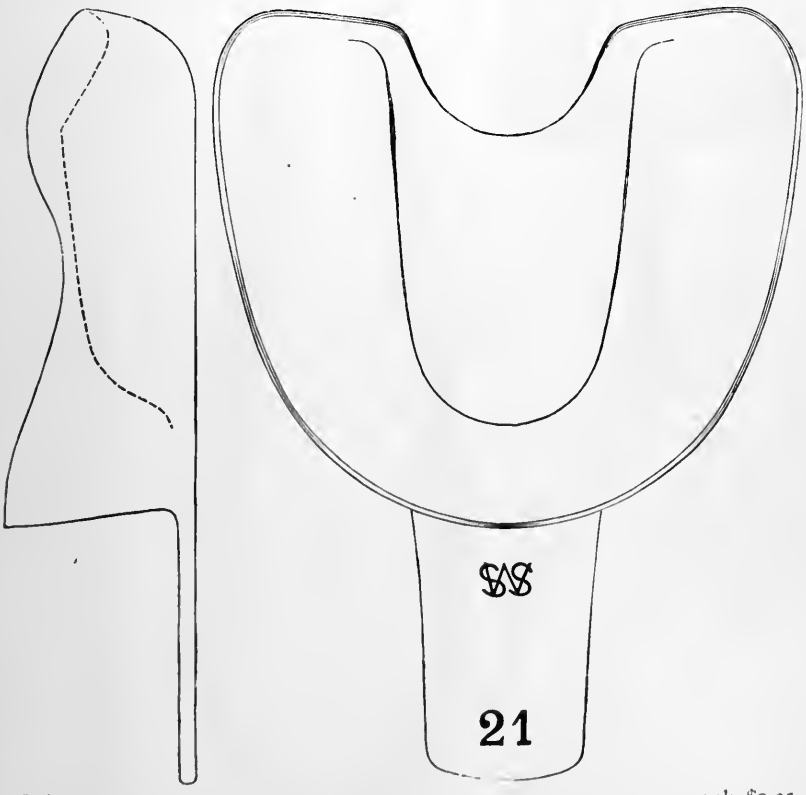
(See Fig. 8 A, and page 20.)

ANGLE'S IMPRESSION TRAYS.

See page 24 for description.

UPPER, Nos. 21, 22, and 23.

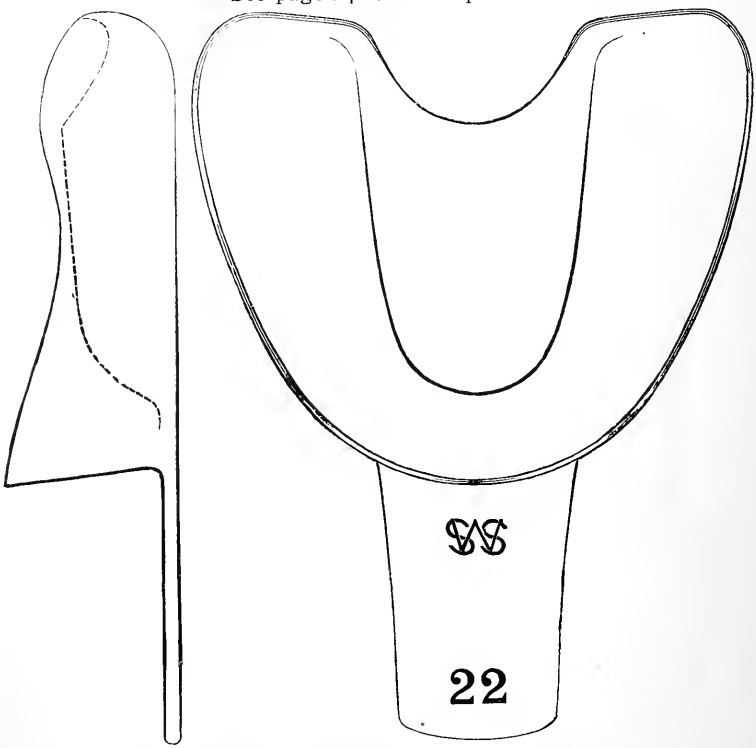


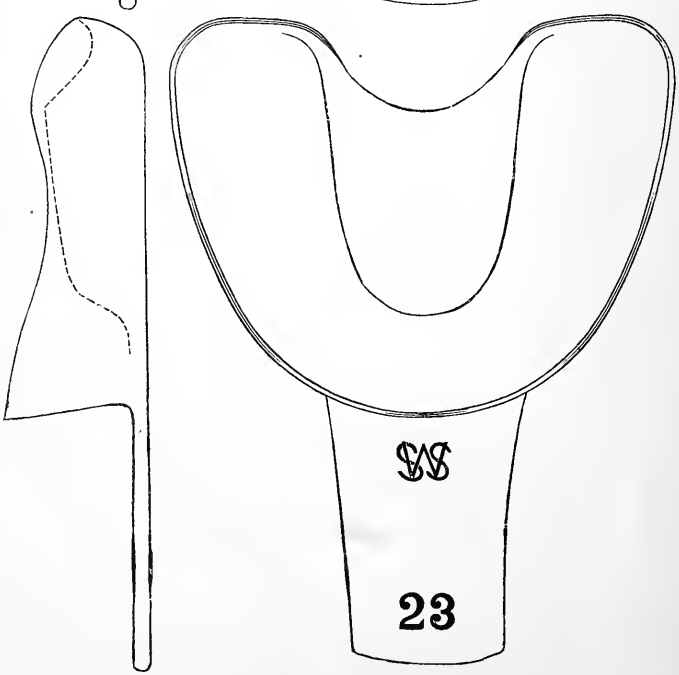


Price.....each $0.35

ANGLE'S IMPRESSION TRAYS.

See page 24 for description.





Price.....each $0.35

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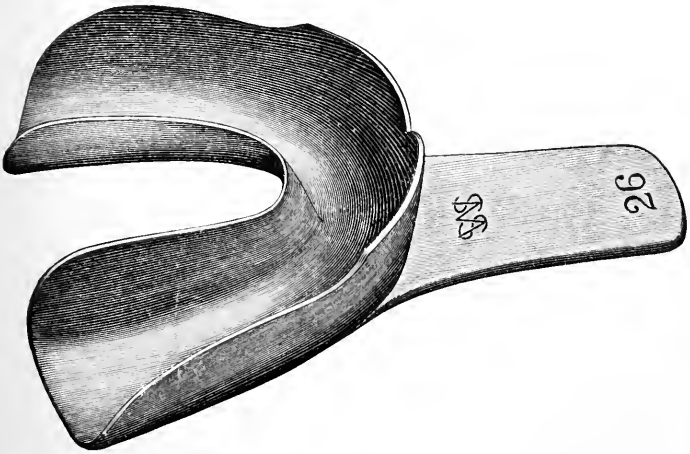
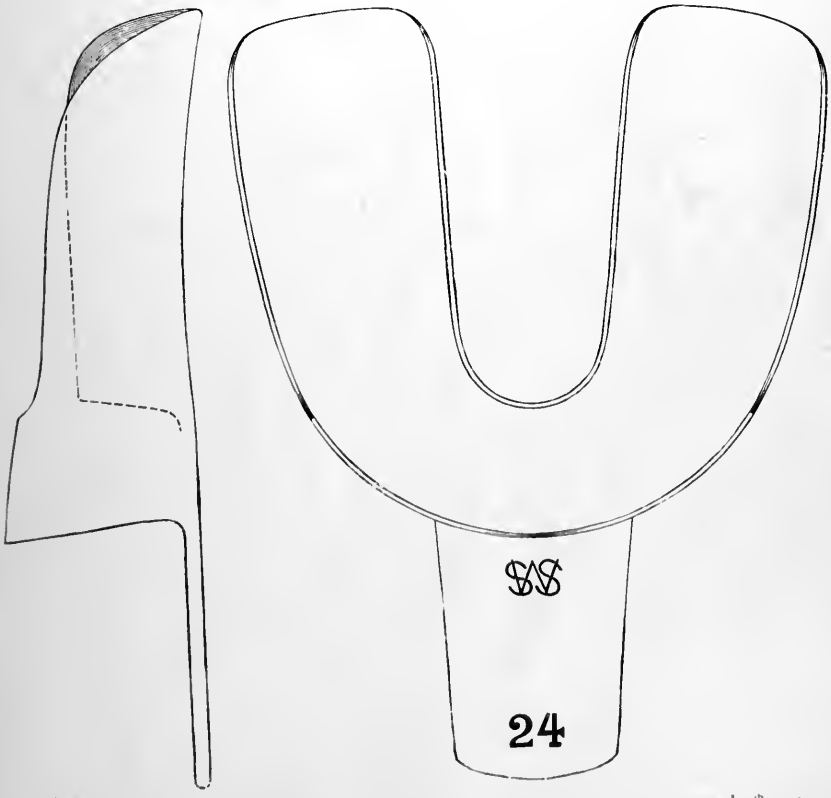
See page 24 for description.

LOWER, Nos. 24, 25, and 26.

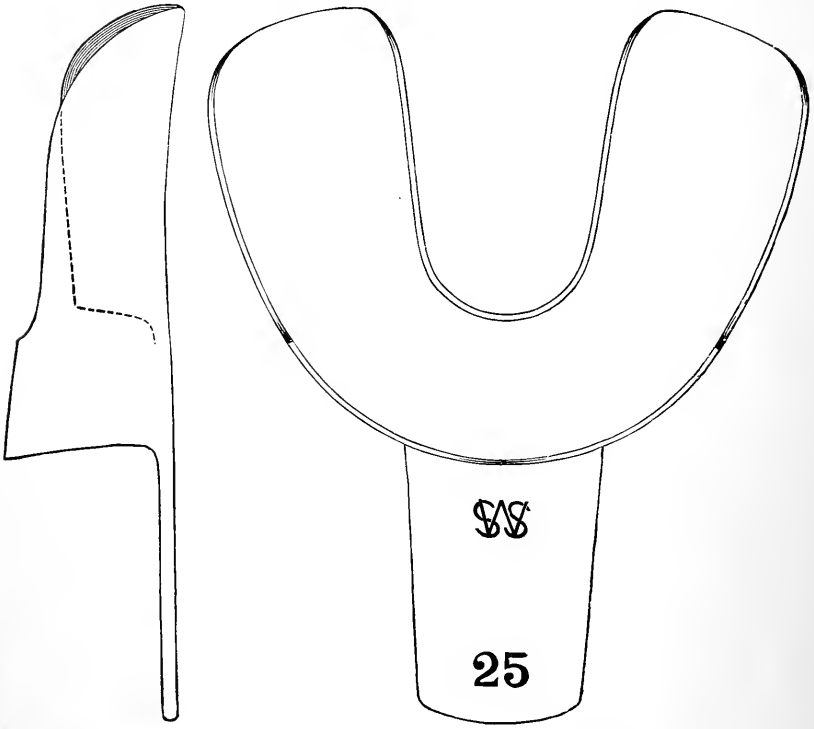


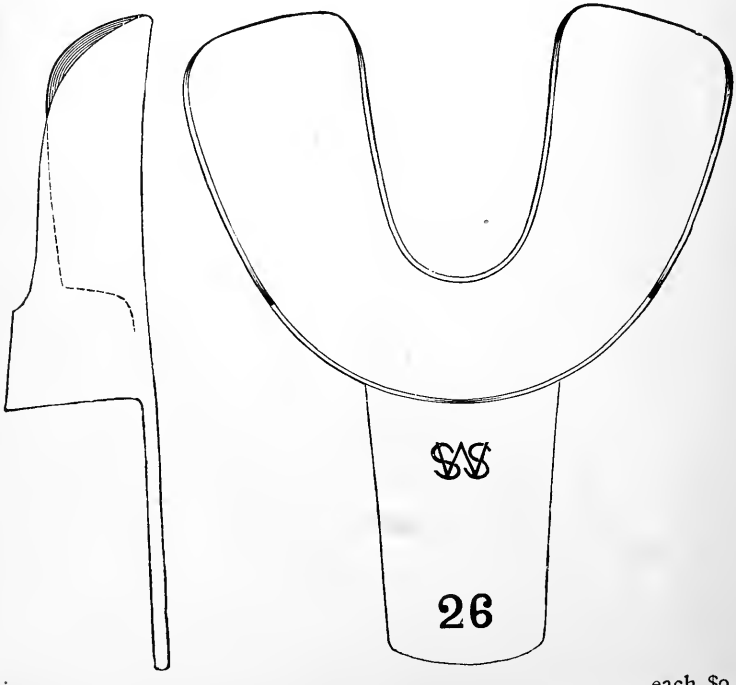


Price.....each $0.35

ANGLE'S IMPRESSION TRAYS.

See page 24 for description.





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